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# A Report On Black-Tailed Prairie Dogs In Nebraska-- Their Biology, Behavior, Ecology, Management, And Responses To A Visual Barrier Fence

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A REPORT ON BLACK-TAILED PRAIRIE DOGS IN  
NEBRASKA -- THEIR BIOLOGY, BEHAVIOR, ECOLOGY,  
MANAGEMENT, AND RESPONSE TO A VISUAL BARRIER FENCE

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1990



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NEBRASKA -- THEIR BIOLOGY, BEHAVIOR, ECOLOGY,  
MANAGEMENT, AND RESPONSE TO A VISUAL BARRIER FENCE

by

Nancy S. Foster

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A REPORT ON BLACK-TAILED PRAIRIE DOGS IN  
NEBRASKA -- THEIR BIOLOGY, BEHAVIOR, ECOLOGY,  
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Nancy S. Foster, M.S.  
University of Nebraska, 1990

Adviser: Scott E. Hygnstrom

I examined the effects of a visual barrier fence, which had a see-through visibility of 60%, on the foraging, vigilance, and aggressive behaviors of adult female black-tailed prairie dogs from June through August 1990 in central Nebraska. I also examined changes in their home ranges and use of an area in response to this fence. Prairie dogs prefer an open view of their surroundings. Therefore, I expected animals near a visual barrier to spend more time in vigilance and aggression, and less time foraging. Adult female prairie dogs exposed to the visual barrier devoted more time to foraging and less time to headbobbing than those not exposed to a visual barrier ( $P = 0.0876$ ,  $P = 0.0150$ ). Only 1 act of aggression was observed during the season. I expected that prairie dogs would move away from the visual barrier fence. The home ranges and core activity areas of adult females were relatively constant in size, shape and location throughout the study. The number of prairie dogs using areas at various distances from a visual barrier fence also did not change over time. These results indicate that the visual barrier

fence tested did not cause prairie dogs to be more vigilant and aggressive, nor did it affect their spatial use within the colony.

In addition to the research project, I wrote 2 popular articles on prairie dogs. These articles covered the following topics: distribution of species, life history, social organization, communication and behavior, associated plant and animal communities, and management. The first article will appear in the June 1991 issue of NEBRASKAland, which is distributed to 60,000 people. The second article was published as a brochure with assistance from the U. S. Fish and Wildlife Service and Chevron Corporation. One-hundred thousand copies of this brochure have been produced and distributed to U. S. Fish and Wildlife Service and Cooperative Extension Service offices.

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I would like to thank Russell and Reita Petersen, Louise Miller, Doug and Sharon Hanks, and the Vance Jeffres family for allowing me access to their land and for providing me with some company and an occasional meal. I also thank Debbie Lee for her assistance in trapping and handling prairie dogs.

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## **EFFECTS OF A VISUAL BARRIER FENCE ON THE BEHAVIOR AND MOVEMENTS OF BLACK-TAILED PRAIRIE DOGS**

### **ABSTRACT**

Prairie dogs prefer an open view of their surroundings and may abandon an area with visual obstructions. I examined the effects of a visual barrier fence, which had a see-through visibility of 60%, on the foraging, vigilance, and aggressive behaviors of adult female black-tailed prairie dogs in central Nebraska. I also examined changes in prairie dog home ranges and use of an area in response to this fence. I expected animals near a visual barrier to spend more time in vigilance and less time foraging. Adult female prairie dogs exposed to a visual barrier spent a greater amount of time foraging and less time in a headbob position than those not exposed to a fence ( $P = 0.0876$ ,  $P = 0.0150$ ). I also expected that prairie dogs would move away from the visual barrier fence over the 54-day period. If they invaded other territories, I expected to see more aggression on colonies with a fence. The size, shape, and location of home ranges and core activity areas of adult females did not change over time as a result of the presence of a visual barrier. I observed only 1 act of aggression and this is likely due to the fact that the study animals did not move into other territories. The number of prairie dogs using areas at various distances from a visual barrier fence also did not change over this time ( $P > 0.900$ ). These results indicate that the visual barrier fence tested did not cause prairie dogs to be more

vigilant and aggressive, nor did it affect their spatial use within the colony.

## INTRODUCTION

Ranchers and farmers have long regarded the black-tailed prairie dog (*Cynomys ludovicianus*) as a serious rangeland pest. Early studies concluded that prairie dogs compete with livestock. Merriam (1902) estimated that 256 prairie dogs ate as much forage as 1 cow, and 32 prairie dogs ate as much as 1 sheep. Kelso (1939) found that over 75% of the plant species consumed by prairie dogs were also valuable forage for cattle and sheep. More recently, Hansen and Gold (1977) estimated dietary overlap of cattle and prairie dogs on a seasonal basis. Similarity was greatest in the spring at 69%, and lowest in the winter at 41%. For the year, they calculated an overlap of 64%.

While cattle and prairie dogs do have similar diets, the amount of competition is questionable. O'Meilia et al. (1982) found that prairie dogs significantly reduced forage availability and use by steers. The annual weight gains of steers grazing with prairie dogs, however, were not significantly different from gains of steers grazing alone. This may have been due to the increased shoot-nitrogen in constantly clipped plants and the higher quality of forbs, which were more available and utilized on prairie dog colonies (O'Meilia et al. 1982, Coppock et al. 1983). Research on the interactions between livestock and prairie dogs is, as yet, inconsistent and inconclusive.

Prairie dogs can have considerable influence on rangelands. They may remove between 18 and 80% of the available forage through feeding, clipping, and burrowing (Taylor and Loftfield 1924, Hansen and Gold 1977, O'Meilia et al. 1982). They affect species composition by encouraging perennial forbs and grasses that are resistant to intensive grazing and useful as livestock forage (Bonham and Lerwick 1976, Coppock et al. 1983). Prairie dogs can also significantly reduce vegetation height and mulch cover (Agnew et al. 1986).

Because of their potential competition with livestock and their impact on rangelands, prairie dogs are a target for control by landowners. Historically, most population reduction was accomplished through the use of poison grain baits, fumigation, and shooting (Fagerstone 1982). The loss of prairie habitat to cultivation and the widespread use of toxicants in the mid-1900's reduced prairie dog populations by 98% (Coppock et al. 1983). The use of toxicants has been severely restricted in recent years, however, and population increases were observed through the 1970's and into the 1980's (Fagerstone 1982, Schenbeck 1982).

Currently, the only poison grain bait registered for use on prairie dogs is zinc phosphide-treated oats. Application of this Restricted Use Pesticide is 75 to 95% effective and costs \$20.00 per ha (Tietjen and Matschke 1982, Knowles 1986, Uresk et al. 1986, Hygnstrom and McDonald 1989). Aluminum phosphide, also a Restricted Use Pesticide, and gas cartridges can be used for fumigation. Application of aluminum phosphide is 85 to 95%

effective on prairie dogs and costs \$62.50 per ha (E. K. Boggess, unpubl. data, S.E. Hygnstrom, unpubl. data). Gas cartridges can be up to 95% effective, but use of this material costs \$87.50 per ha (S.E. Hygnstrom, unpubl. data).

Controlling prairie dogs with toxicants may not be cost-effective over the long term, because dispersing prairie dogs can quickly repopulate treated colonies. Knowles (1986) reduced prairie dog populations by 95% on 2 different colonies using zinc phosphide-treated oats. Within 3 to 5 years, however, the populations had recovered to pretreatment levels. On U. S. Forest Service lands in South Dakota, colonies must be treated with zinc phosphide-treated oats at least every 3 years to maintain control of prairie dogs (Schenbeck 1982). Lethal control is also controversial and not always consistent with land management goals (e.g. national parks). Therefore, recent research has focussed on habitat manipulation as a means of containing or reducing populations (Snell and Hlavachick 1980, Garrett and Franklin 1982, Cable and Timm 1988, Franklin and Garrett 1989).

Colonial animals, like prairie dogs, reduce the risk of predation while foraging in three ways: 1) forage near refuges (i.e. burrows), 2) forage near other animals that are also watching for predators, thus reducing cost per individual, and 3) forage in habitat that permits an unobstructed view of the surroundings (Armitage 1962, Carey and Moore 1986). King (1955) theorized that prairie dogs reduce the risk of predation through both their social habits and habitat modification. Through their clipping and feeding

activities, prairie dogs lower the height of the vegetation, thus improving their field of view and reducing a predator's ability to approach undetected.

Prairie dogs were originally part of the shortgrass prairie fauna and did not extensively utilize the eastern prairie region extensively until the introduction of livestock (Koford 1958). Heavy, continuous use by livestock reduced the plant barriers and created patches of shortgrass prairie dog habitat (Koford 1958). If livestock were removed, however, prairie dogs failed to maintain their colonies (Osborn and Allan 1949, Koford 1958). Because prairie dogs in tall- and mixed-grass prairies cannot control the vegetation height without additional grazing by large herbivores, deferred grazing can be used to reduce prairie dog populations (Snell and Hlavachick 1980). Removal of livestock from an area may allow the vegetation to become higher and more dense. Prairie dogs may then disperse, because they do not prefer habitat with visual obstructions. This technique may not be effective, however, in sites or years with low plant productivity (Cable and Timm 1988).

Franklin and Garrett (1989) tested the use of artificial visual barriers to control population expansion. The activity of prairie dogs near a burlap fence declined significantly over a 2-month period. Colony expansion along the edge with the fence was also less than where no fence was present. Similar results were found in areas with windrows of pine trees. They concluded that visual barriers may be effective in certain situations, but their use was limited due to high labor costs in maintenance and construction.

As part of a larger study on the efficacy of Tensar snowfence (Tensar Manufacturing Co., Inc.) as a visual barrier fence for reducing repopulation of controlled areas, I examined the behavioral responses of black-tailed prairie dogs to a visual barrier fence.

Specifically, I examined the effects of a visual barrier fence on:

- 1) foraging, vigilant and aggressive behaviors of prairie dogs,
- 2) home ranges of individual prairie dogs, and
- 3) the level of prairie dog activity in an area.

I hypothesized that the number of prairie dogs near a visual barrier fence would decrease over time, as happened with burlap fence and pine tree windrows. I also predicted that the home ranges of prairie dogs exposed to a visual barrier would shift away from the fence. I hypothesized that more aggression would occur on these colonies, as the displaced individuals entered other coterie territories. I also predicted that prairie dogs near a visual barrier would be more vigilant than prairie dogs not exposed to a fence. Hoogland (1979b, 1981) found that along the edge of a colony prairie dogs devoted significantly more time to alert postures than animals in the center of a colony. He concluded that this was in response to the greater vegetative cover and lower prairie dog density along the colony edge. If the animals near a visual barrier fence spent more time in vigilance, I expected them to spend less time feeding than control animals.

## METHODS

### Study area

This study was conducted on 4 black-tailed prairie dog colonies in Garfield and Loup counties in central Nebraska. The area is on the eastern edge of the Sandhills prairie. Annual precipitation in this region averages 49 cm, with 75% falling between April and September (White and Hubbard 1989). The primary soil type in the area is Valentine fine sands (Lewis 1989). The predominant grass species on the prairie dog colonies was blue grama (*Bouteloua gracilis*). Primary native vegetation away from prairie dog colonies includes: little bluestem (*Schizachyrium scoparium*), sand bluestem (*Andropogon gerardii paucipilus*), prairie sandreed (*Calamovilfa longifolia*), needle-and-thread (*Stipa comata*), and sedges (*Carex* spp.) (Kaul 1989).

Study sites were selected using the following criteria: landowner cooperation, location, colony size, and prairie dog density. Landowner cooperation was a primary factor in selecting study sites. Permission to build observation towers and the visual barrier fences was necessary, as was daily access to each colony. In addition, landowners could not control prairie dogs during the study except through shooting, which was allowed on all four colonies. All colonies were located within 15 km of Burwell, Nebraska, so that all 4 colonies could be visited in a single day. The size of the study sites ranged from 6 to 15 ha. The maximum acceptable colony size was 15 ha, to facilitate visual observations and population

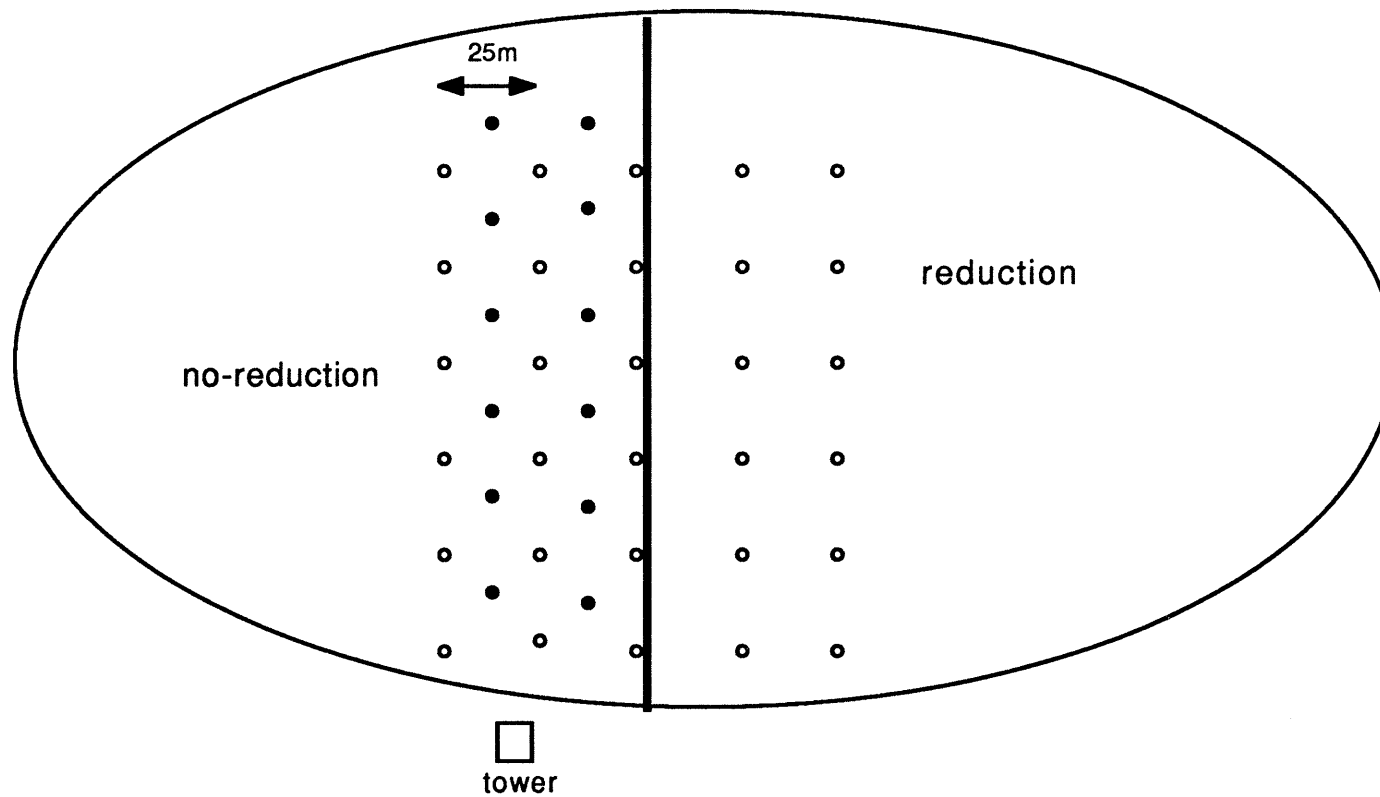


reduction. I attempted to find colonies with similar prairie dog densities.

I randomly chose half of each colony and reduced the prairie dog population in that area to a level assumed to be 0. Reduction was accomplished through a combined use of zinc phosphide-treated oats and a variety of fumigants. Immediately following fumigation on June 20 and 21, 1990, a visual barrier fence was installed on colonies 1 and 2 (Figure 1). The fence divided the treated and untreated halves of each colony. The material used was Tensar snowfence -- a black polyethylene plastic mesh, 0.6 m high, with a see-through visibility of 60%. Colonies 3 and 4 served as control sites; the population on 1/2 of each colony was reduced to 0, but no fence was installed. Assignment of the fence treatment was random, except in the case of study site 4. A fence on this colony may have impeded access to water by livestock, so it was designated as a control site.

To facilitate data collection on movements of prairie dogs within 50 m of the fenceline, I marked off a 25 m interval grid with 0.5 m color-coded fiberglass posts on each colony (Figure 1). A post was also placed in the middle of each grid square, as an additional reference point. The grid extended 50 m into both the no-reduction and reduction areas. The length of the grid ranged from 75 to 125 m, depending on colony size. The same amount of colony edge was included in each grid area.

Figure 1. Diagram of colony showing reduction and no reduction areas, fenceline, and 25m-interval grid (open circles) with center stakes (closed circles).



### Study animals

I live-trapped prairie dogs in the no-reduction grid areas May 10 through June 26, 1990. After prebaiting an area with oats for 2 to 4 days, I set 15x15x60 cm single-door Tomahawk traps near active burrows and baited them with oats. I transferred captured prairie dogs from the trap to a canvas bag for weighing, sexing, and aging. I marked all prairie dogs with Nyanzol D fur dye for identification in the field. Juveniles were marked with a spot on the rump, and adult males with a spot on the head. Adult females were marked with unique patterns of lines for individual identification in the field and ear-tagged for permanent identification. I observed the behavior of adult females only, because their behavior and home ranges are relatively constant after the young emerge (J. L. Hoogland, pers. comm.). A juvenile does not respond to danger as an adult would, and its movements are not restricted to its coterie territory. The behaviors of an adult male may be more affected by the number of potential territory invaders. Any response exhibited by adult females during the summer would more likely be due to the presence of a visual barrier.

### Behavior Measurements

I observed the behavior of adult female prairie dogs from June 22 through August 14, 1990. I divided each day into four intervals: early morning (0600-0900), late morning (0900-1200), late afternoon (1500-1800), and evening (1800-2100). In the summer, these are the times of day when prairie dogs are most active (King 1955). I randomly selected the interval during which a colony was

visited each day. All behavioral data were obtained while the observer was seated in a blind. Elevation of the blinds varied between 0 and 3 m, depending on the topography of the colony. Observations were usually made with a 15-45x zoom spotting scope mounted on a tripod, and occasionally with 7x35 binoculars. Prairie dogs within any part of the grid area could be clearly observed.

After a habituation period of at least 15 minutes, I randomly selected a marked adult female that was aboveground, within the grid area, and not giving an alarm call. I counted the number of prairie dogs within 25 m of this "focal animal" before collecting behavioral data. I derived my ethogram from behaviors described by King (1955) and Hoogland (1979a, 1979b) (Table 1). I observed the animal for 5 minutes and recorded its behavior at 15 second intervals ("instantaneous sampling"; Altmann 1974). A tape recorder provided a quiet click at the end of every 15 second period, enabling the observer to constantly watch the focal animal. Observations were terminated after 3 consecutive "out of view" recordings were made: usually the animal had gone underground.

Each colony was visited at least 5 times per week, for 2 hours per day. On average, I observed each marked adult female once per visit. When an individual prairie dog was observed more than once per day, I assumed that data on its behavior that were obtained at least 30 minutes apart were independent (Hoogland 1979b). Data from prairie dogs observed less than 2 minutes in 1 occasion or on fewer than 10 occasions were not used in the analysis, because of the likelihood of sampling error.

Table 1. Behaviors of black-tailed prairie dogs.

---

Forage -- animal searches for, manipulates, or consumes food items

Vigilance --

Upright alert posture -- animal stands on its hind legs, apparently searching for danger

animal may forage in upright alert posture

Headbob -- animal lifts its head up for 1 to 5 seconds, apparently examining its surroundings

animal may forage while headbobbing

Aggression --

Chase -- animal pursues another fleeing individual, or flees from a pursuing individual

Runaway -- following an approach, animal runs away from another, with no pursuit involved

Tail-spread dispute -- ritualized form of aggression that involves exposure and sniffing of anal glands

Fight -- animal involved in direct physical contact with another individual (i.e. biting, scratching)

Other -- animal involved in activity not listed above (i.e. grooming, locomotion, burrowing)

Out of view -- animal not visible to observer

---

I used a nested split plot design with weighted variances to determine the effects of the treatment and the time of day on time allocation by prairie dogs. Variances were weighted because they were neither homogenous nor normally distributed. No transformation of the data would satisfy these assumptions. The treatment was the whole plot factor, and the time of day, based on the 4 intervals, was the split plot factor. The treatment effect was analyzed using the corrected error term of colony within treatment. Due to the small sample sizes ( $n = 2$ ),  $P$  values less than 0.1000 were considered significant. I also used the number of aboveground prairie dogs as a covariate. This measure had no significant impact on the behaviors of prairie dogs ( $P \geq 0.1375$ ), so it was removed for final analysis.

#### Home Range Analysis

At the beginning of each 5-minute observation period, I recorded the location of the focal animal on a map of the grid area. I was only interested in prairie dogs that would be responding to the treatment, i.e. within 50 m of the fence line. I did not record the locations of marked prairie dogs when they were off the grid area. Therefore, what I will refer to as a prairie dog's home range is really that part of its home range within the grid area. I used a harmonic mean method to analyze the home range data (Dixon and Chapman 1980). The season was divided into 2 periods, June 22 to July 18 and July 19 to August 14. Home ranges and core activity areas were calculated for each prairie dog during both time periods. Because of small sample sizes, I used a 90% contour to define an

animal's home range instead of the standard 95% isopleth (J. Coleman, pers. comm.). The latter tended to overestimate home ranges, excluding only 1 or 2 exploratory locations. Core activity areas were defined using 50% and 25% isopleths. The center coordinates of each animal's home range were calculated using harmonic means (Sokal and Rohlf 1969). I used t-tests to compare the changes in the x and y coordinates of home range centers of prairie dogs exposed to a visual barrier fence (experimental animals) and those not exposed (control animals). I also used t-tests to compare changes in center coordinates between the first and second time periods within each colony.

#### Activity Level

At the end of each visit, I recorded the amount of activity in different sections of the grid area. Activity was defined by the number of prairie dogs observed in each of the following areas: within 12.5 m of fenceline, 12.5 to 25 m from fenceline, 25 m to 37.5 m from fenceline, and 37.5 m to 50 m from fenceline. I also recorded the number of prairie dogs observed in the reduction grid area.

I calculated the average number of prairie dogs in each grid section on each colony between June 22 and July 18 and between July 19 and August 14. Prairie dog distributions among the no-reduction grid sections in the first time period were compared to distributions in the second period for each colony using a  $X^2$  contingency table (Steel and Torrie 1980). These comparisons were made to determine if the number of prairie dogs using the area near

a fence decreased over time. Comparisons could not be made between treatments or among colonies because densities of prairie dogs in the grid areas were not equal.

## RESULTS AND DISCUSSION

### Population Characteristics

I trapped 116 prairie dogs from the no-reduction grid areas (Table 2). On colonies 2 and 4, the number of juveniles trapped may include some recaptures that lost their original marks in molt. The young emerged on or about May 10 with very blond and rough coats. Within the first few weeks of aboveground activity, they shed this coat and acquired one similar to that of adults. I did not observe this blond coat on juveniles trapped in June.

Adult males had completed their spring molt before I started to trap. Generally, a colony has fewer adult males than any other sex-age group (King 1955, Tielston and Lechleitner 1966). On colony 2, however, 22 adult males were trapped. It is difficult to distinguish between adult males, who breed, and yearling males, who do not yet breed. The body weights of adult males on this colony were significantly lower than those on the other colonies ( $P = 0.001$ ). This suggests that the high number of males captured on this colony might include many yearling males, who would disperse in June.

Adult females were just beginning to molt in the second week of May. The molt process begins at the head and continues back to the tail, lasting about 2 weeks. When I captured prairie dogs in



Table 2. Body weight (g) of live-trapped prairie dogs, Nebraska, 1990.

Colony	Trapping Dates	Juveniles			Adult Males			Adult Females			No. observed in study
		$\bar{x}$	s	N	$\bar{x}$	s	N	$\bar{x}$	s	N	
1	June 4 - May 9	381	65	18	1106	77	6	870	85	12	6
2	May 23 - June 1	270	58	22	886	114	22	706	62	8	3
3	June 14 - June 26	443	74	18	1300	70	2	1000	151	4	3
4	May 10 - May 21	195	83	13	1083	132	4	784	98	11	2

molt, I applied the Nyanzol D fur dye on sections of the coat where molt was nearly complete. The number of adult females trapped does not include recaptures because these animals were ear tagged at first capture. Several captured animals were not observed because they either lost their marks in molt or were killed in the final fumigation.

### Behavior

During this study, 571 independent animal-observation sessions were made, yielding 11,825 instantaneous samples. The average number of samples per 5-minute interval was 19.7, of 20 possible (Table 3).

Only 1 act of aggression was observed during the summer. Therefore, I grouped aggressive behaviors into the "other" category for analysis. Time budgets of prairie dogs exposed to a visual barrier and of those not exposed to a visual barrier are shown in Table 4.

I expected that prairie dogs exposed to a visual barrier would spend more time in vigilance than control animals, because the view of their surroundings was limited by the visual barrier fence. The experimental animals would consequently have less time to spend foraging. I found, however, that experimental animals spent significantly more time foraging and less time headbobbing than did the control animals ( $P = 0.0876$ ,  $P = 0.0150$ ). It is unlikely that the visual barrier would have caused prairie dogs to forage more and be less vigilant than the control animals, because in the study by Franklin and Garrett (1989), they abandoned an area with a visual

Table 3. Frequency of observations and total number of samples per focal animal, Nebraska, 1990.

Treatment	Colony	Prairie dog	Number of 5-minute intervals	Number of instantaneous samples
Barrier	1	670	32	634
		669	58	1151
		667	20	400
		664	41	807
		662	31	599
		641	38	755
	2	677	39	778
		625	25	496
		617	50	988
	No barrier	3	635	39
633			63	1240
632			30	584
4		610	50	994
		602	49	978

Table 4. Effects of a visual barrier fence on proportion of time spent per behavior of black tailed prairie dogs, Nebraska, 1990.

Behavior	Visual barrier (n = 338)		No visual barrier (n = 233)		<i>P</i>
	$\bar{x}$	s	$\bar{x}$	s	
Foraging	0.640	0.255	0.486	0.307	0.0876
Upright alert	0.079	0.116	0.111	0.156	0.1414
Foraging in upright alert	0.076	0.084	0.061	0.079	0.3360
Headbob	0.084	0.146	0.217	0.285	0.0150
Foraging in headbob	0.054	0.050	0.064	0.061	0.6671
Other	0.137	0.203	0.131	0.204	0.8439

obstruction. The results I observed may have been due to some factor other than the fence treatment.

I may have observed behavioral responses to forage productivity or the level of other disturbances (i.e. predators, shooting) (Stockrahm 1979). These factors were not controlled nor determined and their effects are unknown. Another possibility was a behavioral response to colony density. Hoogland (1979b) concluded that the amount of time an individual spends in vigilance is inversely related to prairie dog density. In setting up the experiment, I attempted to find colonies with similar prairie dog densities. I calculated grid density using the number of prairie dogs counted at the end of each visit. There was no significant difference between the densities on the control and the experimental grids ( $P = 0.148$ ). Therefore, I conclude that the differences I observed in foraging and headbobbing were not due to prairie dog density.

I also examined the effect of time of day on the behavior of prairie dogs. They devoted significantly more time to foraging in the evening than in the early morning ( $P = 0.0595$ ) or late morning ( $P = 0.0142$ ). I observed significantly more prairie dogs using the no-reduction grid area in the evening than in the late morning ( $P = 0.0030$ ) or late afternoon ( $P = 0.0090$ ). These results are consistent with Hoogland's (1979b) conclusion that the prairie dogs spend more time foraging when more conspecifics are in the immediate area.

Prairie dogs spent significantly less time foraging in a headbob position in the late morning than in the early morning ( $P = 0.0157$ ) or evening ( $P = 0.0069$ ). If the predators of prairie dogs are

more active at dawn and dusk, it would be reasonable to expect more vigilance at these times. Foraging in a headbob position is probably the least costly of the 4 vigilant behaviors. This behavior probably involves lower energy expenditure, compared to raising up on its hind legs, and an input of energy through simultaneous foraging.

### Home Range

On experimental colonies, I expected prairie dogs to shift away from the visual barrier fence, because they prefer areas with no obstruction of their view. The x coordinate of the center of an animal's home range measured its distance from the visual barrier fence. I found no significant difference between the first period x coordinates of experimental animals and the second period x coordinates (Figures 2 and 3; Table 5,  $P > 0.400$ ). On the experimental colonies, home range size, shape and location remained approximately the same for 7 of the 9 adult females studied.

On colony 1, prairie dog 662 remained in the same general area over the summer, but her home range was much smaller during the last half. The area of the 90% isopleth was reduced from 1060 m<sup>2</sup> in size to only 290 m<sup>2</sup>. This could have been due to greater resource partitioning among prairie dogs later in the growing season, or to some undetected factors.

The home range of prairie dog 667 on colony 1 did change considerably over the summer. During the 2 weeks following construction of the fence, she was observed 0 to 50 m from the fence in the no-reduction area. I first observed this animal in the reduction area on July 9. Two days later it was seen back in the no-

Figure 2. Home ranges and core activity areas, defined by 90%, 50%, and 25% isopleths, of prairie dogs in grid area of colony 1 with visual barrier.

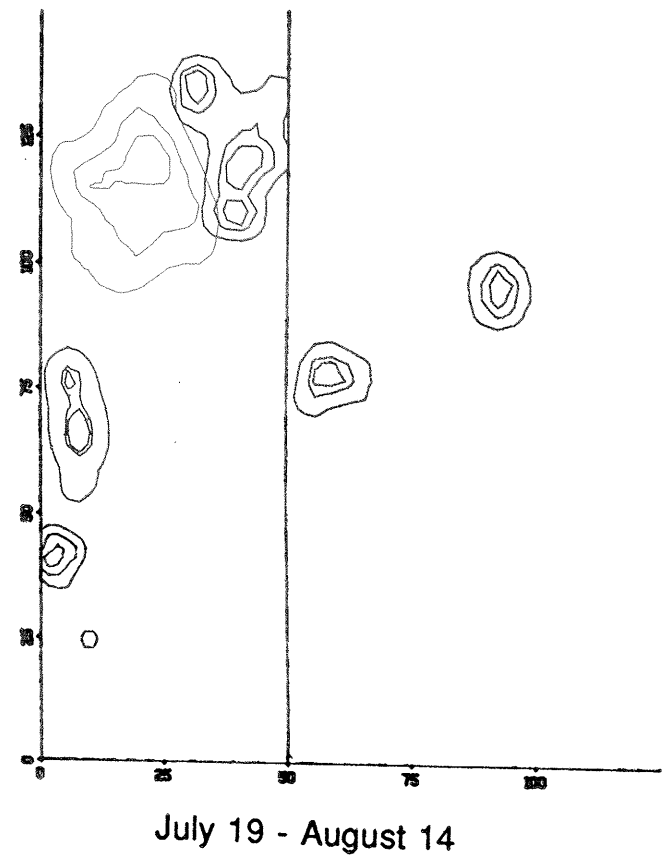
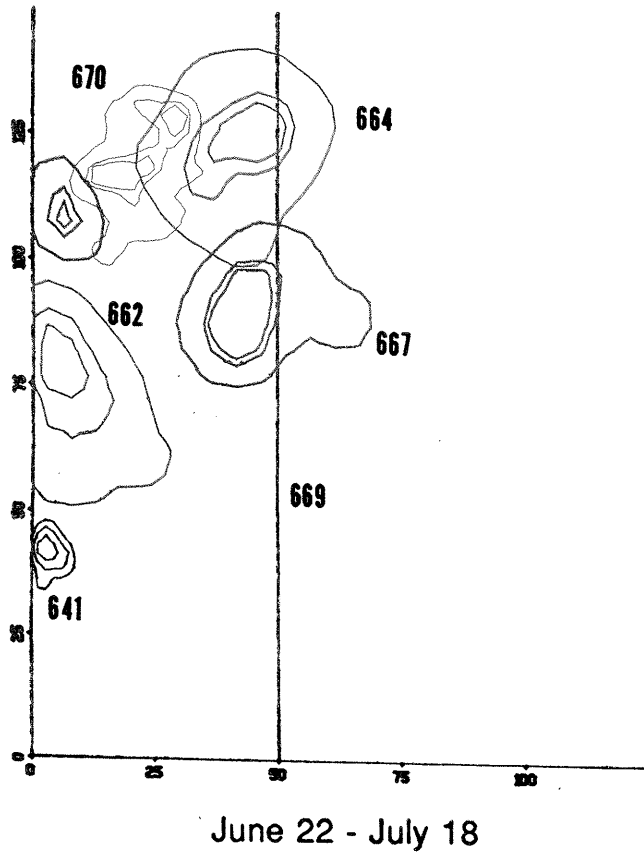
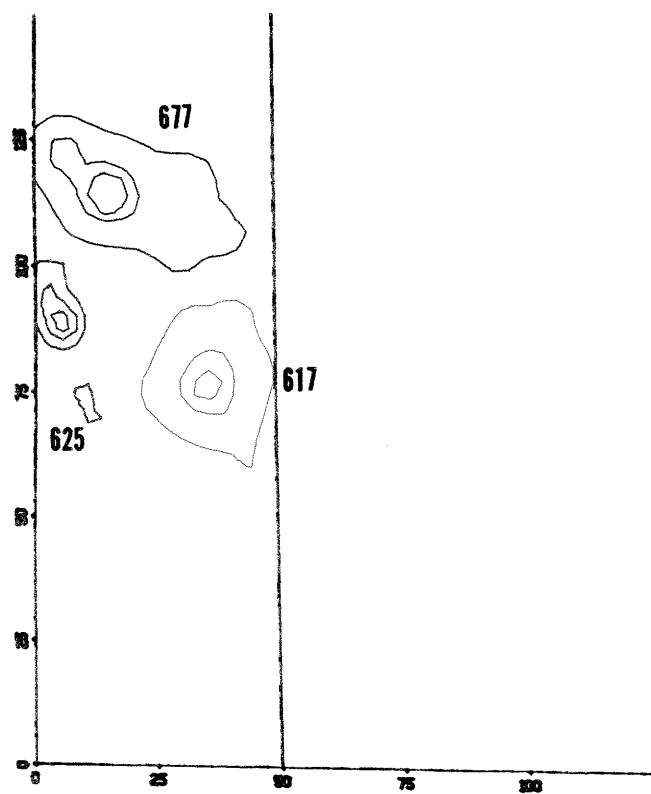
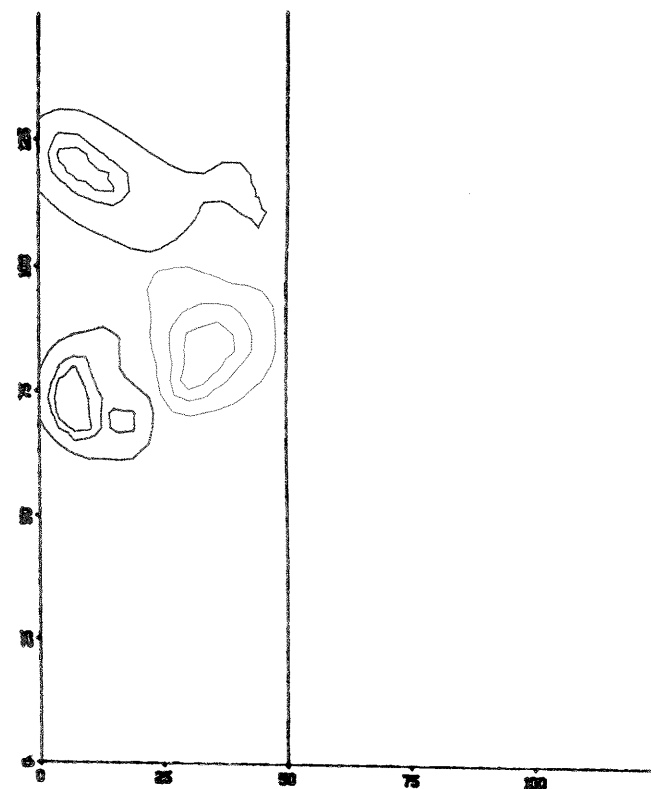


Figure 3. Home ranges and core activity areas, defined by 90%, 50%, and 25% isopleths, of prairie dogs in grid area of colony 2 with visual barrier.



June 22 - July 18



July 19 - August 14



Table 5. Shifts in harmonic centers of activity areas of black-tailed prairie dogs exposed and not exposed to visual barriers between June 22 - July 18 and July 19 - August 14, Nebraska, 1990.

Prairie dog	Distance moved toward barrier (m)	Distance moved toward blind (m)
Visual barrier		
670	-6.5	3.3
669	5.2	3.2
667	58.1	9.2
664	-1.3	-1.5
662	1.4	-3.5
641	-0.3	4.2
677	-3.1	1.9
625	4.1	-10.0
617	-2.1	7.9
No visual barrier		
635	6.1	-0.8
633	1.7	0.6
632	-2.8	-2.6
610	0.9	8.9
602	-17.0	2.7

reduction area, but after that it was only observed in the reduction area. It is possible that this animal was returning to the home range occupied prior to fumigation. Also, marked and unmarked juvenile prairie dogs had been observed in the reduction area since June 26 and prairie dog 667 may have relocated to be with these young.

I expected that the home ranges of adult females on control colonies would either not shift or shift into the reduction area. There was no significant difference between the x coordinates of the home ranges in the first period and in the second period (Figures 4 and 5; Table 5,  $P > 0.800$ ). Three of the 5 females on colonies 3 and 4 continued to use home ranges of similar size, shape, and location.

Prairie dog 632 was captured in the no-reduction grid area of colony 3, but was observed there only one other time. This animal's home range was most likely always in the reduction area and she survived fumigation. Movements into the no-reduction area may have been exploratory or to exploit a new food resource, such as the oats used for trapping.

On colony 4, the home range of prairie dog 610 covered 3460 m<sup>2</sup> during the first half of the summer. This animal was seen exploring the reduction area 7 times in the 2 weeks following fumigation. At one time, she was observed 50 m into this area, "kissing" an adult male. The "kiss" is the means by which prairie dogs identify each other as members of the same coterie. These 2 animals did not appear to recognize each other, as he chased her back to her core activity area then returned to his original location.

Figure 4. Home ranges and core activity areas, defined by 90%, 50%, and 25% isopleths, of prairie dogs in grid area of colony 3 with no visual barrier.

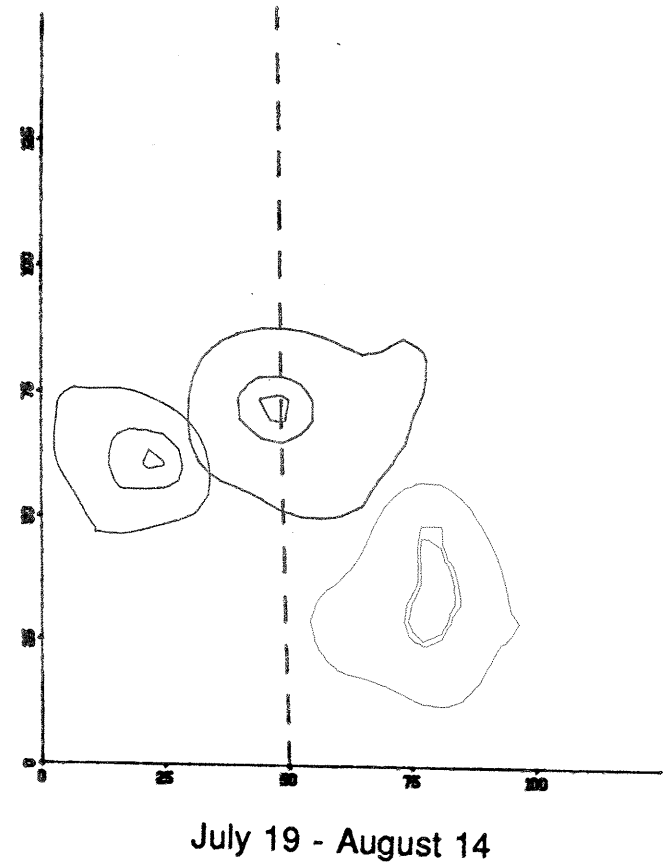
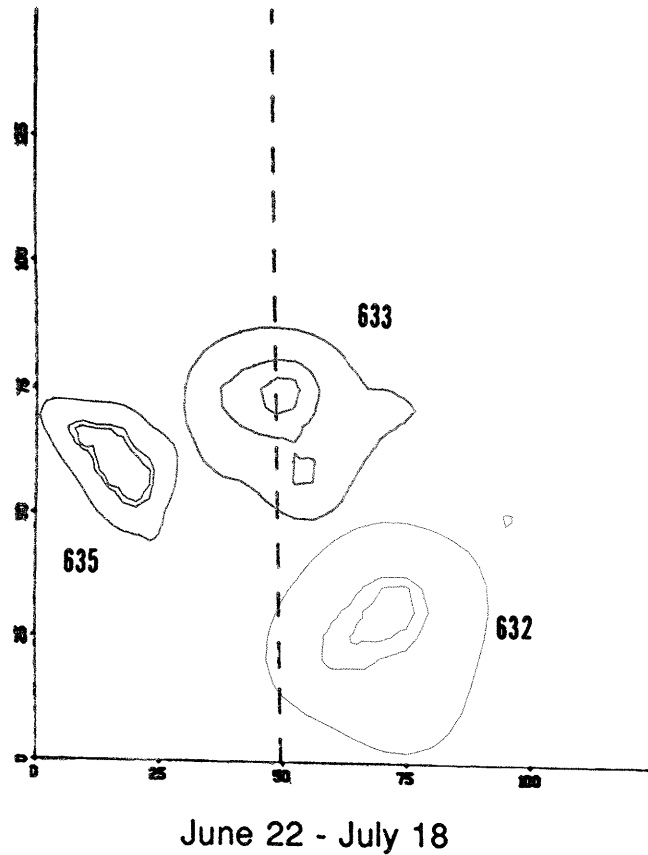
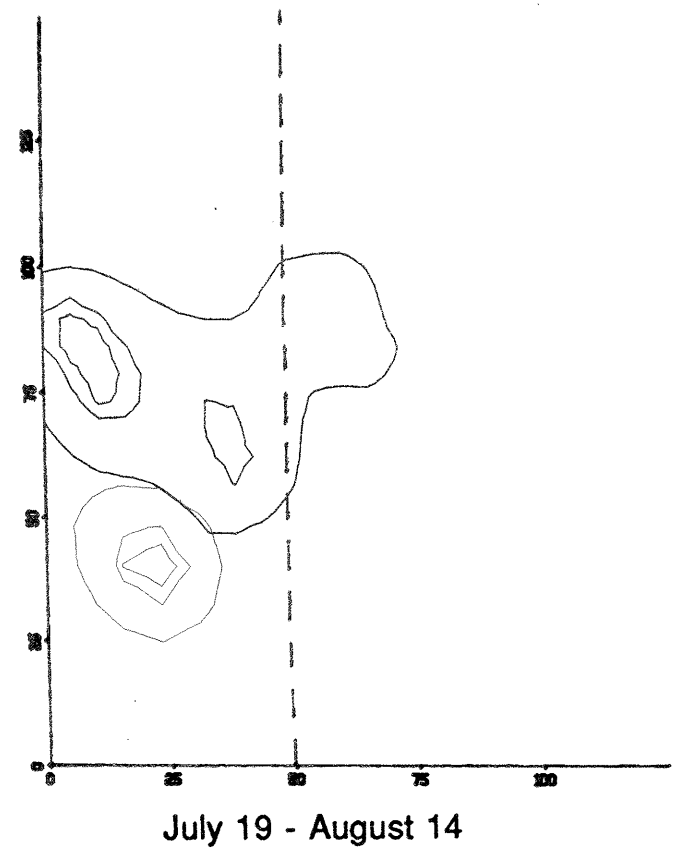
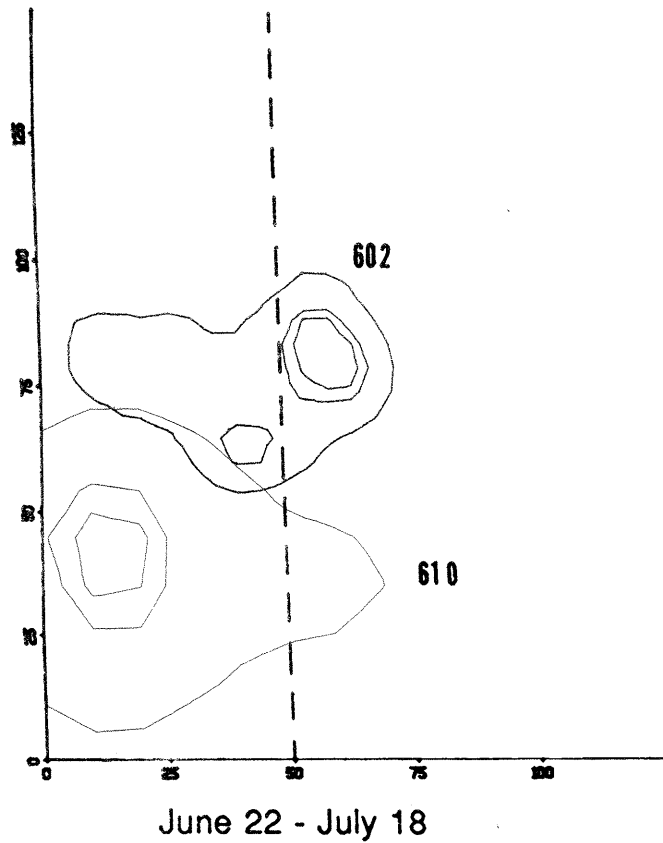


Figure 5. Home ranges and core activity areas, defined by 90%, 50%, and 25% isopleths, of prairie dogs in grid area of colony 4 with no visual barrier.



Prairie dog 610 did much less exploring in the last part of the study, when she primarily used a 600 m<sup>2</sup> area in the same location as her earlier core activity areas.

The home range of prairie dog 602 on colony 4 remained relatively the same size, but shifted 17 m away from the reduction area. Cattle grazing was not evenly distributed on this colony. The reduction area and the adjacent 25 m of the no-reduction area were grazed June 10 to June 20. The remainder of the no-reduction grid area was opened to cattle on July 17. It did not appear that the vegetation in her original area had grown high enough to interfere with visibility, and other prairie dogs still used that area. Prairie dog 602's movement may have been a response to some other aspect of cattle grazing, such as higher nutritional quality.

Ten of the 14 study animals continued to use the same home ranges throughout the summer. Home ranges did not shift towards nor away from a visual barrier. Also, the presence of an observation blind did not have a significant effect on the y coordinates of the centers of activity in either treatment or control animals (Table 5,  $P \geq 0.904$ ).

Aggressive encounters, such as the one described above, were rare, because for the most part prairie dogs did not leave their original home ranges. This lack of aggression during the summer months is consistent with other prairie dog populations (King 1955, Hoogland 1979a).

One unique aspect of the home range analysis was the subdivision of the grid area among adult females. Hoogland (1983)

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observed that females defended subterritories within the coterie during gestation and lactation. Once the young emerged, however, all coterie members foraged over the entire coterie territory. I observed that females tended to subdivide the grid area throughout the summer. This could be a function of resource abundance and/or colony density. I saw more overlap among female home ranges on colony 1, where density was the greatest.

#### Activity Level

On all colonies, the number of prairie dogs observed in the reduction area was significantly lower than in the no-reduction area ( $P \leq 0.008$ ). On colony 1, use of the reduction area was significantly higher in the last half of the study than in the first half (Figure 6,  $P = 0.008$ ). This is influenced greatly by prairie dog 667, who's relocation was discussed earlier. Use of the reduction area on colony 2 did not change significantly over time (Figure 7,  $P = 0.538$ ). The same results were found on colony 3 (Figure 8,  $P = 0.261$ ). On colony 4, the number of prairie dogs using the reduction area decreased significantly during the summer (Figure 9,  $P = 0.022$ ). The higher number of prairie dogs in the first half of the study may have included animals exploring the recently abandoned area. These animals may have never established definite activity areas there or they may have moved out in response to the grazing system, as discussed earlier.

Prairie dog distribution across the 50 m of the no-reduction grid area did not change significantly on any colony (Tables 6 and 7,  $P > 0.900$ ). These results contrast with those of Franklin and

Figure 6. Changes over time in number of prairie dogs observed within 50 m of the fenceline in reduction area and no-reduction area of colony 1, Nebraska, 1990.

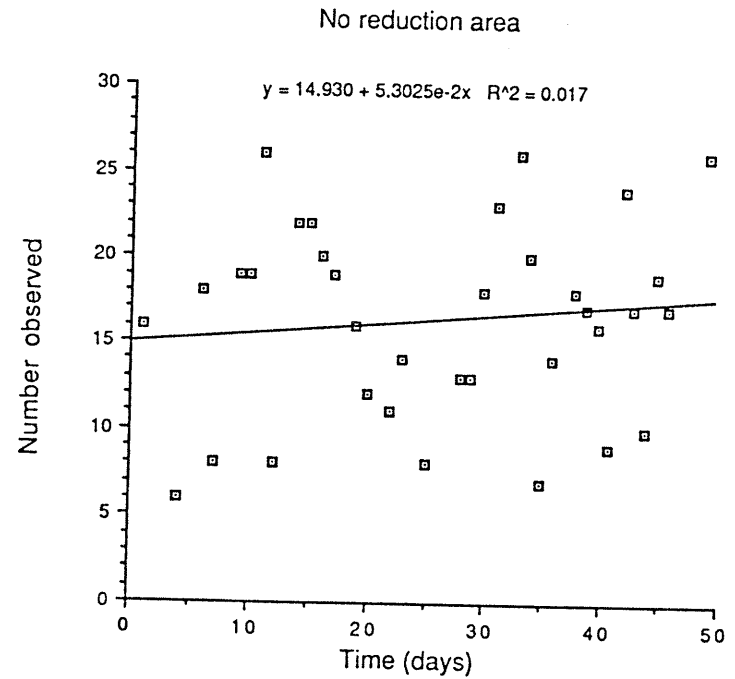
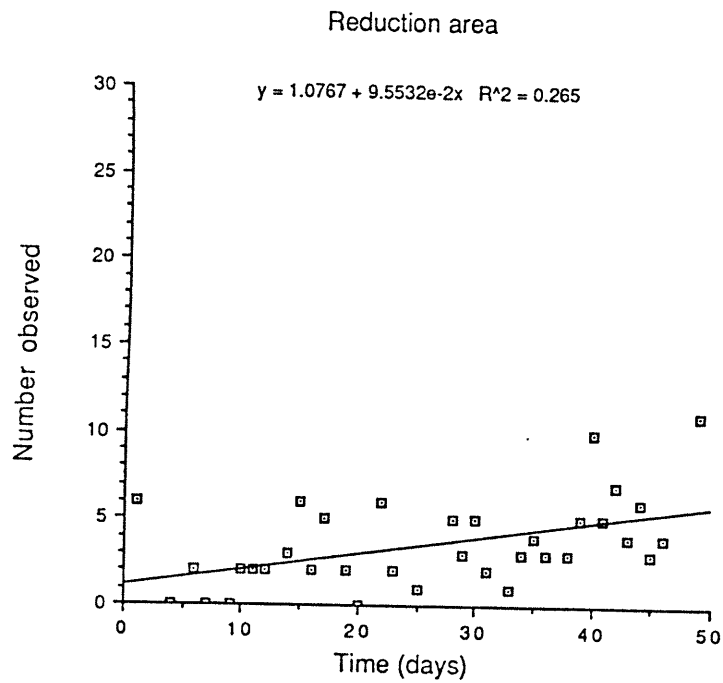




Figure 7. Changes over time in number of prairie dogs observed within 50 m of the fenceline in reduction area and no-reduction area of colony 2, Nebraska, 1990.

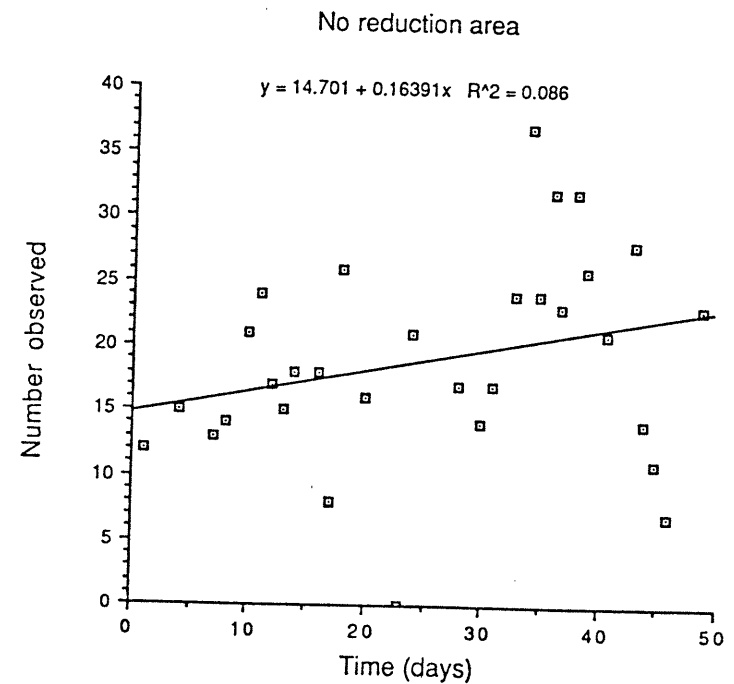
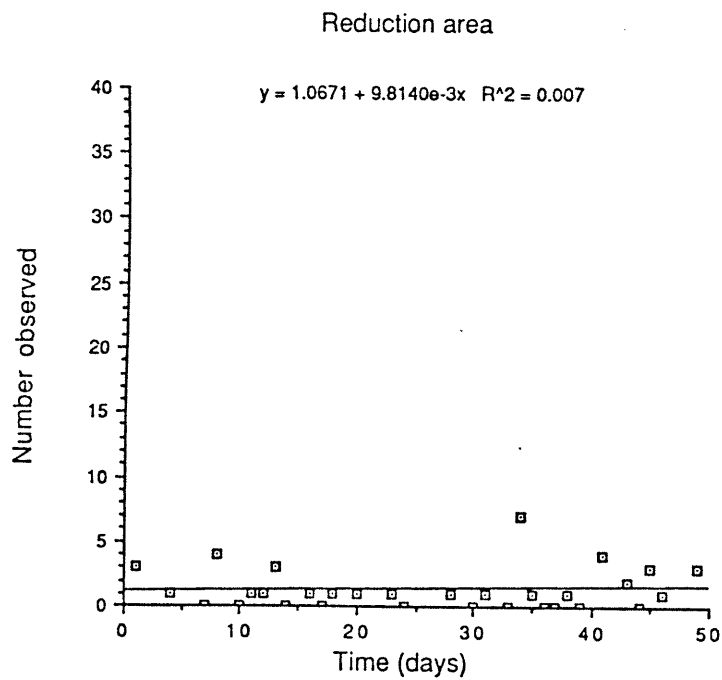


Figure 8. Changes over time in number of prairie dogs observed within 50 m of the fenceline in reduction area and no-reduction area of colony 3, Nebraska, 1990.

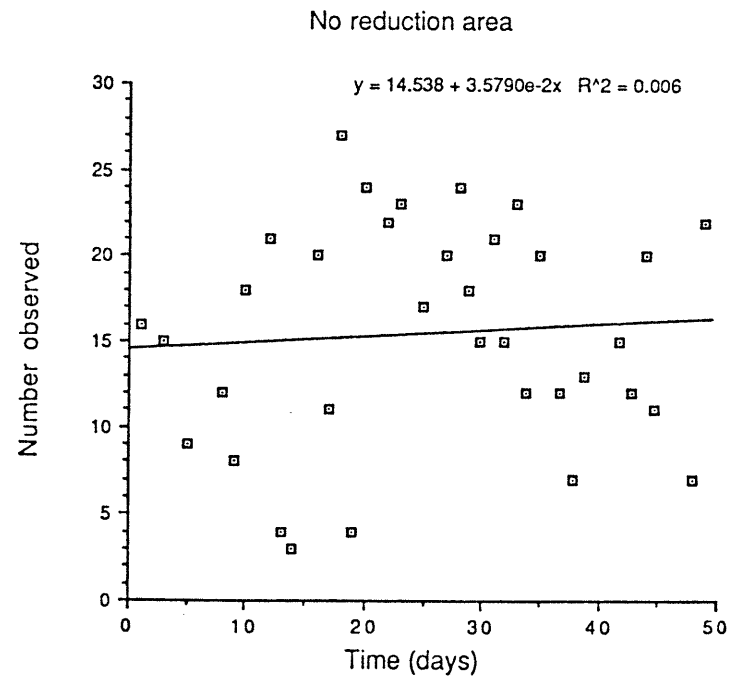
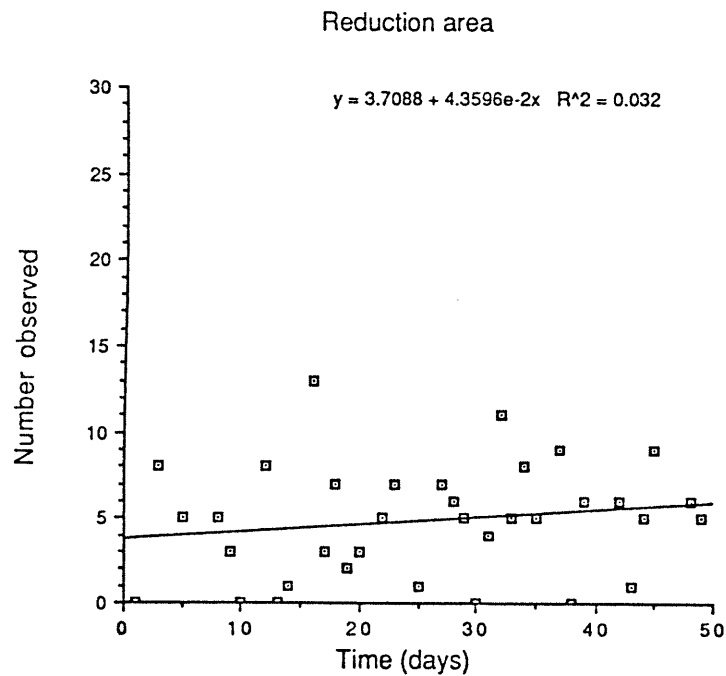


Figure 9. Changes over time in number of prairie dogs observed within 50 m of the fenceline in reduction area and no-reduction area of colony 4, Nebraska, 1990.

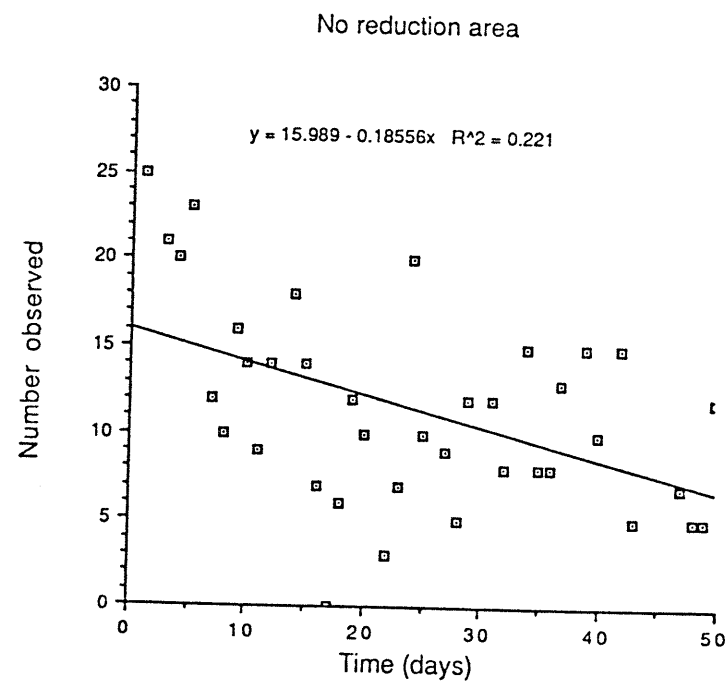
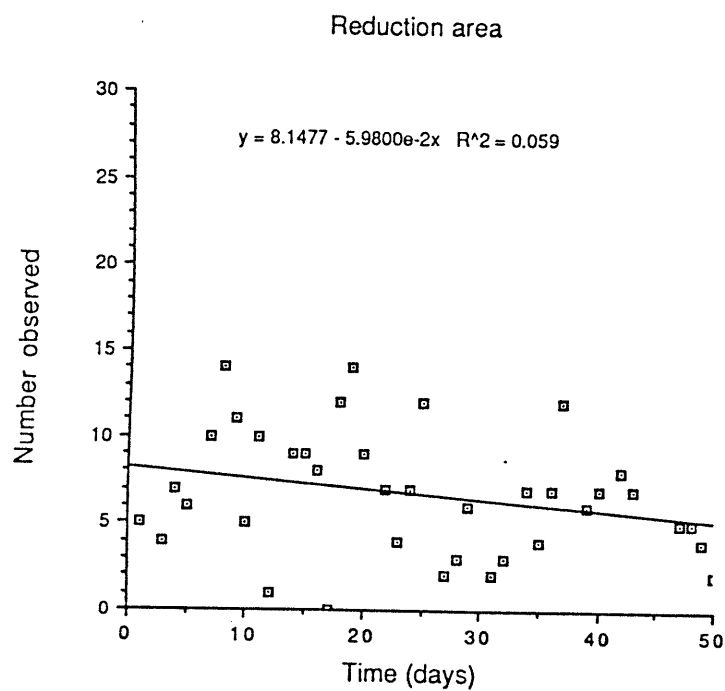


Table 6. Average number of prairie dogs observed in grid areas in colonies with visual barriers, Nebraska, 1990.

Distance from barrier		Number observed	
		June 22 - July 18	July 19 - August 14
Colony 1			
No-reduction area	0 - 12.5 m	3.118	3.167
	12.5 - 25.0 m	2.706	3.556
	25.0 - 37.5 m	2.000	3.389
	37.5 - 50.0 m	7.706	6.944
	0 - 50.0 m	15.529	17.056
Reduction area	0 - 50.0 m	2.412	4.667* *
Colony 2			
No-reduction area	0 - 12.5 m	1.867	2.438
	12.5 - 25.0 m	3.333	4.625
	25.0 - 37.5 m	4.933	7.813
	37.5 - 50.0 m	5.733	7.000
	0 - 50.0 m	15.867	21.875
Reduction area	0 - 50.0 m	1.133	1.500*

\*  $P < .05$

\*\* $P < .01$

Table 7. Average number of prairie dogs observed in grid areas in colonies with no visual barriers, Nebraska, 1990.

	Distance from barrier	Number observed	
		June 22 - July 18	July 19 - August 14
Colony 3			
No-reduction area	0 - 12.5 m	3.765	4.444
	12.5 - 25.0 m	1.882	2.611
	25.0 - 37.5 m	5.471	4.611
	37.5 - 50.0 m	3.824	4.278
	0 - 50.0 m	14.941	15.944
Reduction area	0 - 50.0 m	4.176	5.444
Colony 4			
No-reduction area	0 - 12.5 m	2.905	1.353
	12.5 - 25.0 m	3.714	2.471
	25.0 - 37.5 m	2.810	3.176
	37.5 - 50.0 m	3.476	2.647
	0 - 50.0 m	12.905	9.647
Reduction area	0 - 50.0 m	7.810	5.294

\*  $P < .05$

\*\*  $P < .01$

Garrett (1989). Over a 2-month period, they observed a 61% reduction in use of an area with a burlap fence. They observed the most reduction during the first month of exposure to the visual barrier. During the second month, the number of prairie dogs using the experimental area was relatively constant. In the control area, on the opposite side of the 1.86 ha colony, use by prairie dogs gradually increased 97%. I did not study use of control areas within each colony. However, I did not observe a reduction in use of the no-reduction areas of colonies 1 and 2. Therefore, I conclude that the Tensar snowfence does not deter the use of an area by prairie dogs as the burlap fence does.

### CONCLUSIONS

Adult female prairie dogs exposed to a visual barrier fence spent more time foraging and less time in a headbob position than those not exposed to a fence. The home ranges of the experimental and control animals did not shift in response to the visual barrier nor the observation blind. Most of the adult females occupied the same home ranges throughout the summer. The visual barrier did not affect prairie dog use of an area in the same manner that the burlap fence and windrows did in the study by Franklin and Garrett (1989).

The use of visual barrier fences to control repopulation and colony expansion by black-tailed prairie dogs is based on an understanding of the biology, behavior, and habitat requirements of the species. The fences do not exclude prairie dogs from an unoccupied area. Instead, they act as a psychological barrier by

interfering with their view of the area (Franklin and Garrett 1989). It is possible that the movement of the burlap fence or the noise it made blowing in the wind caused prairie dogs to abandon the area. However, the pine tree windrows, with which less noise and movement would have been associated, were also effective in controlling prairie dogs. This suggests that the effectiveness of a visual barrier fence depends on its ability to interfere with a prairie dog's view of its surroundings. Visibility through the black Tensar snowfence is 60%, compared to 0% through the burlap. The lower amount of obstruction offered by the Tensar fence may not have interfered enough with the social behaviors or the habitat requirements of prairie dogs to cause them to abandon the area. Further research should be conducted on visual barriers using materials with the high durability of Tensar snowfence and the low visibility of burlap fence.

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## LITTLE DOGS ON THE PRAIRIE

by Nancy S. Foster and Scott E. Hygnstrom

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In 1804, Captains Lewis and Clark set out with the Corps of Discovery on their historic journey up the Missouri River, over the Rocky Mountains, and to the Pacific Ocean. They carried with them instructions from President Jefferson to observe "the animals of the country generally and especially those not known in the U.S." This proved to be an exceptional task, for ahead of them lay vast grasslands inhabited by a multitude of unfamiliar fish, reptiles, amphibians, birds and mammals. By the end of their journey, these explorers had documented 122 new species or subspecies. In Nebraska the one new mammal discovered was the small, sociable prairie dog.

Lewis and Clark discovered their first prairie dogs in what is now Boyd County, Nebraska. About their new discovery, Clark said, "The village of these animals covered about four acres of ground on a gradual descent of a hill and contains great numbers of holes on top of which those little animals sit erect, make a whistling noise, and when alarmed, step into their hole." Obtaining specimens of prairie dogs proved difficult. A private in the Corps was able to shoot one, at which time all of the others disappeared. The group then tried to dig out the animals. After going down six feet, only to find no end to the runways, they resorted to flooding. The men spent nearly an

entire day carrying water from the river and pouring it into a hole. They were able to capture only one more. Little did they know at the time that they would encounter this "barking squirrel" many more times before their journey's end.

Lewis and Clark named the prairie dog for the barking noise it makes. It is not a dog, nor is it related to any canine. The prairie dog is really a rodent and is closely related to ground squirrels and marmots. Five species of prairie dogs are found in North America: the black-tailed, Mexican, white-tailed, Gunnison's and Utah prairie dog. Only one species, the black-tailed prairie dog, occurs in Nebraska. It is the most abundant and widely distributed of the five species, living in groups scattered across the prairies from northern Mexico to southern Canada. The animal is cinnamon brown in color with buffy undersides and, as its name indicates, has a black-tipped tail. Adults may weigh one to three pounds and are 14 to 17 inches long. At last count they occupied approximately 70,000 acres of land in Nebraska. The Mexican prairie dog also has a black tipped tail, but is smaller than its northern relative. This species occurs only in Mexico, where it is listed as endangered.

White-tailed, Gunnison's and Utah prairie dogs all have white tipped tails. The white-tailed prairie dog lives in sparsely populated colonies on sagebrush plateaus of the Rocky Mountains. It is usually smaller than its close cousin, the black-tailed prairie dog, weighing between 1-1/2 and 2-1/2 pounds. Gunnison's prairie dog, the smallest of the five species, inhabits open grassy and brushy

areas at higher elevations. The Utah prairie dog is found only in south-central Utah and is a threatened species.

In the summer of 1990, we studied the behavior of black-tailed prairie dogs in Nebraska. Black-tails are the most social of the five species, living in colonies or "towns" built on slopes less than 10 percent and on well-drained, finer soils. Towns may range in size from one to over 1,000 acres. The largest town ever recorded was found in Texas at the beginning of the 20th century. It measured 100 miles wide and 250 miles long, and contained an estimated 400 million prairie dogs! The average town in Nebraska, however, only covers about 30 acres.

One of the most obvious features of a prairie dog town is the abundance of mounds and holes. Prairie dogs are equipped with short, muscular front legs and long claws useful for burrowing. Black-tailed prairie dog towns usually have about 40 burrow entrances per acre, but there may be as many as 95 per acre in some towns. Each burrow entrance leads to a tunnel three to six feet deep and about 15 feet long. Not all tunnels in a town are connected. In fact, most tunnel systems have only one opening.

Prairie dogs often dig small chambers just below the surface, where they sit and listen for above-ground activity. Deeper below-ground, they make nest chambers, where they sleep and care for their young. Prairie dogs use the soil excavated from their tunnels to construct crater- and dome-shaped mounds up to two feet high and 10 feet in diameter! Most mound construction and repair occurs shortly after a rain, when the soil is more workable. A prairie dog

scrapes soil from around a mound or digs it out of a burrow. The animal then pushes the soil to the mound and tamps it into place with its nose. Mounds serve as lookout stations for prairie dogs and at the same time prevent water from entering the tunnels.

Another distinct feature of prairie dog towns is the vegetation. Generally, the plant species found on a prairie dog town are different from those in the surrounding rangeland. The vegetation is more open and diverse. The digging and scratching by prairie dogs leaves bare patches of soil, which are excellent sites for annual forbs (broad-leafed, herbaceous plants) to become established. Their greatest impact on the vegetation, however, is through their feeding.

Prairie dogs spend almost 50 percent of their above-ground time feeding. In the summer, they feed mostly in the early morning and evening. During the hottest part of the day, they go below-ground where it is much cooler. Grasses and sedges are the preferred food in spring and summer, when shoots are most succulent. Prairie dogs do not drink free water, and must rely on water contained in plants.

In the late summer, as green grass becomes scarce, prairie dogs eat more forbs, including some that are toxic to livestock and other wildlife. Besides increasing forb uptake, prairie dogs also eat seeds and insects in preparation for the winter. Black-tailed prairie dogs do not hibernate, nor do they store food for use in the winter. When the weather is most severe, they are able to stay underground for several days and live off of their body fat. On sunny winter

afternoons, they come out to bask in the sun and forage on any green plant parts available. Winter is a particularly rough time for prairie dogs and as many as 30 percent of the adults die.

Prairie dogs do not eat everything growing on the town. Some plants, such as thistle, are not preferred as food by prairie dogs or many other herbivores. These plants are clipped at the base and left to dry in the sun. Prairie dog feeding and clipping has the effect of eliminating the taller vegetation. This encourages the more nutritious forbs and short perennial grasses that are resistant to intensive grazing. Also, by eliminating the taller plants on a town, prairie dogs deprive predators of any cover for stalking, and improve their ability to detect danger.

The prairie dog town is more than just a bunch of holes and short vegetation. It is the basis for a complex social structure. Larger colonies are often divided into "wards" by a topographic feature, like a hill or a stream. Residents of a ward may be able to see and hear those of adjacent wards, but movement among wards is uncommon. Within a ward, each family, or "coterie," of prairie dogs occupies its own territory, which covers about one acre. Often, one edge of the territory is adjacent to unoccupied grasslands. This ensures ample food for coterie members. A coterie usually contains one adult male, three or four related adult females, and their offspring less than two years old. The travels of a prairie dog are generally restricted to its family's territory. The only exception to this is the very young, who are allowed to explore neighboring

coterie in their first summer. As they grow older, though, these visits are discouraged by the adults in other territories.

Members of a coterie are very sociable, sharing burrows and food resources within their territory. They maintain their unity through physical contact. When two coterie members meet, they open their mouths and touch their teeth together. This "kiss" is used to distinguish a coterie member from an outsider. An intruder will often leave the area when faced by a resident with bared teeth. Coterie members, on the other hand, recognize and accept each other's presence. Following the kiss, prairie dogs will often engage in elaborate mutual grooming. All coterie members groom each other, but the young, in particular, are quite persistent in seeking attention from the adults. They will pounce on adults or crawl under their chins as the adults try to feed. At times they become such nuisances that the harassed adult will try to escape by moving away from its own territory.

Rarely do prairie dogs from the same coterie antagonize each other. There are certain situations, however, when the fur can fly. For example, occasionally more than one adult male will live in the same coterie. Only the dominant male, however, will breed. To establish his dominance, a male will chase other males into their burrows, and even attempt to fill the burrow entrances with soil to keep his rivals from coming out. Females with young in their burrows can also be quite aggressive. Males that approach nest burrows are chased away easily, but when another female approaches the tension rises and a fight may even develop. Once the



young emerge, there is almost no aggression among coterie members, who instead focus their aggression on intruders.

Cooperation and acceptance are limited to the coterie and relations among members of different coteries can be quite hostile. Most disputes arise over territory boundaries, which all members of a coterie will actively defend. When a prairie dog trespasses into an adjoining coterie, it may be rushed at by a resident of the area. The intruder will usually retreat after this first rush. Sometimes, however, the trespasser will refuse to leave. What follows is a ritual of threatening postures that biologists call the "tail-spread dispute." The two animals will rush towards each other, stopping about six feet apart. Then, one turns, raises its tail and exposes its anal glands to its opponent. The latter cautiously approaches to sniff the exposed region. They then exchange roles. This continues until one attempts to bite the rump of the other. The bitten animal walks off a few feet, but soon returns to the dispute. Before it is all over, there is much charging, sniffing and biting. The result is a change in the boundary line of only a few feet and rarely is there much more injury than a nip on the rump.

Occasionally, an invasion is not accidental, but instead it is a purposeful takeover attempt by an aggressive male. He will spend several days or weeks exploring burrows along the border and acquainting himself with some of the residents. If threatened by a resident, the invader will run, but he tests his opponent's resistance by running around the edge of the territory instead of leaving it right away. Eventually, there will be a showdown between the invader and

the resident dominant male. These fights are probably the only time prairie dogs are truly vicious, leaving permanent scars on their opponents. The victor establishes himself as the dominant male of the coterie and the loser retreats from the area. The coterie stability is very important for prairie dogs, because reproduction occurs only between members of the same coterie.

Unlike most rodents, success of the prairie dog is not because of its fecundity. Prairie dogs breed only once a year. In Nebraska, the breeding season begins in mid-February and lasts about three weeks. The gestation period is 34 or 35 days and litters are small compared to most rodents, containing only three to five pups. The young are born naked, blind and totally helpless. For the first seven weeks of their lives they remain underground in the complete care of their mother. During the second week of May, the pups emerge and are weaned within a few days. Infant and juvenile mortality is as high as 50 percent in prairie dogs. As much as 51 percent of the juvenile mortality is through infanticide, which occurs when a mother fails to defend her nest from related females. Ironically, the female who loses her pups to infanticide will sometimes nurse other pups in the coterie.

Pups that survive the first summer are nearly full grown by the time winter comes. They will not breed, however, until they are almost two years old. Female prairie dogs can live up to eight years and usually stay with their natal coterie their entire lives. This could cause genetic problems, but prairie dogs avoid inbreeding through a variety of behaviors. Older males usually move to

different coterie before their daughters reach sexual maturity. If the father is still present during a female's first breeding season, they either avoid each other, or the coterie splits and the daughter breeds with an unrelated male.

Females are unlikely to breed with any other male relatives, because male prairie dogs move away from their natal coterie before their first breeding season. Most dispersal occurs in the late spring when the cool-season grasses are abundant and the weather is more mild. Despite this timing, dispersal is risky business, as prairie dogs leave the safety of their burrows and enter unfamiliar territory. Some move to neighboring coterie, but others will travel up to five miles before establishing their own territories. When they reach a new colony, they are faced with hostility from the residents, and are forced to live on the edge of town where the grass is tall and the burrows are shallow. Survival of dispersing prairie dogs is less than 50 percent. Even if a male successfully disperses and establishes his own territory, he will probably not live more than five years.

Predation is a major cause of adult mortality. Badgers are a serious threat to prairie dogs because they can dig deep into burrows. Weasels and black-footed ferrets, on the other hand, do not have to dig out their prey. With their stream-lined bodies, they can slink through burrows to capture prairie dogs. Other predators, like coyotes, bobcats, and foxes, must rely on their ability to stalk prairie dogs feeding on the outskirts of the town. They will also sit and wait at burrow entrances for unsuspecting prairie dogs to come

out. Hawks and eagles regularly soar over or perch near towns to search for mice, rabbits and prairie dogs that have wandered too far from a burrow. Prairie rattlesnakes and bull snakes may take some young, but are not a great threat to adult prairie dogs.

Despite the concentration of prey on a prairie dog town, there isn't necessarily a free meal for predators. During the course of their daily activities, prairie dogs frequently lift their heads or stand on their hind legs to survey their surroundings. When a prairie dog detects a predator, it retreats to a burrow mound and gives a series of short nasal yips as a warning. Nearby prairie dogs stop what they are doing, stand on their hind legs and look for the source of danger. If they spot the predator, they will run and dive into their burrows or perch atop their burrow mounds and join in the "barking" chorus. In case of extreme danger, the town will become quiet almost instantaneously, and no prairie dogs can be seen anywhere. Eventually, prairie dogs emerge from their burrows with caution. Their large eyes and inconspicuous ears are set high on their heads, enabling them to examine the area without leaving the safety of their burrows. If there are no more signs of danger, the prairie dogs will come out and give a "jump-yip" call.

The "jump-yip" call is a very distinctive, high-pitched call that can be heard loud and clear across the town. It is not known if this call is given by a prairie dog staking its territory, or as a signal to others that "all is clear." When giving the jump-yip, the prairie dog rises on its hind feet and, with its nose pointed skyward, throws itself into the air. Occasionally, the animal puts so much energy

into the leap that it will tumble over backwards. This call seldom goes unanswered, spreading across the town like "the wave" at a football stadium.

Not every animal that frequents a prairie dog town causes alarm, which is good because as many as 140 different species of wildlife may be associated with prairie dog towns. At first, prairie dogs are wary of new visitors, but those that prove to be harmless are given little attention. Pronghorn antelope are attracted by the abundance of forbs on the town and may spend most of their day feeding among prairie dogs. Bison, deer and elk prefer the more nutritious forage found on prairie dog towns. The well-constructed mounds serve as excellent wallowing areas for bison.

Vacant prairie dog burrows serve as homes for cottontail rabbits and several species of small rodents. Deer mice and kangaroo rats are attracted by the annual plants that grow on the disturbed soils and grasshopper mice feed on the beetles, grasshoppers and other small rodents found in abundance on towns.

Many birds, such as meadowlarks and grasshopper sparrows, appear in greater numbers on prairie dog towns than in surrounding prairie. These songbirds are attracted by the increased amount and visibility of seeds and insects. An interesting bird often seen perched on prairie dog mounds is the burrowing owl. These owls typically nest in abandoned prairie dog burrows or badger holes. They rarely feed on prairie dogs, but instead prefer the insects and smaller mammals found nearby. The burrowing owl is only one of several uncommon or rare species that use prairie dog towns.

Others include the golden eagle, prairie falcon, ferruginous hawk, mountain plover, swift fox, and black-footed ferret.

The black-footed ferret is a special inhabitant of prairie dog towns. Today, this animal is so rare that it is listed as an endangered species. Black-footed ferrets establish their dens in prairie dog burrows and feed almost exclusively on prairie dogs. The reduction in prairie dog numbers in the last 100 years and the disappearance of many large towns has likely led to the decline of the ferret population.

Several times during this century, scientists believed that the black-footed ferret was extinct. Fortunately, in 1981, a small population of ferrets was discovered near Meeteetse, Wyoming. These ferrets were captured, and a successful captive breeding program has set the stage for reintroduction of ferrets into the wild, possibly even Nebraska. The reintroduction of this rare animal, however, is dependent on our ability and willingness to provide excellent habitat--large and healthy prairie dog towns.

The presence of prairie dogs is not always compatible with agriculture and other human land-use interests, but through proper management we can coexist. We should strive to conserve some prairie dogs because they are an important part of the prairie ecosystem. They manipulate the vegetation to create islands in a sea of grass. Many species of mammals, birds and reptiles are attracted to these islands for cover or food. Some of these animals are not common away from prairie dog towns and it is always a thrill to see one of the rarer animals, like a swift fox. Prairie dogs

themselves are interesting to watch. Their communication system is amazing and the juveniles are always up to some mischief. If you enjoy watching wildlife and want to see a lot of activity, go visit the little dogs on the prairie.

Sidebar in the article addressing damage and control

Prairie dogs are regarded as pests by some people for a variety of reasons. They are the most frequently cited reservoirs for sylvatic plague in the western United States. This disease has not yet been identified in Nebraska, however. At times prairie dogs forage in crops and destroy irrigation systems. The most common concern, however, is the impact of prairie dogs on rangelands and livestock production. Cattle and prairie dogs both prefer grasses, and their diets can overlap by as much as 70 percent. Prairie dogs may also remove 18 to 80 percent of the available forage through feeding, clipping, and burrowing. The presence of prairie dogs, however, is not always detrimental to livestock production. The vegetation on a prairie dog town is often higher in nutritional quality. Some research has shown that cattle actually prefer to feed among prairie dogs and have rates of gain similar to those foraging away from a colony.

Prairie dogs have been a target for control since the late 1800s when the population was estimated at five billion. The first control efforts, shooting and trapping, had little impact on their numbers. Poisoning campaigns, started in the 1930s were much

more effective. These efforts, combined with a tremendous loss of native prairie to cultivation, caused a 98% reduction in prairie dog numbers.

Landowners wanting to control prairie dogs today have a limited number of tools with which to work and in some areas, prairie dog populations are increasing. Currently, there are only two fumigants and one poison grain bait registered for use on prairie dogs. These materials are 75 to 95 percent effective, but the use of toxicants is becoming more controversial. They can also be costly and often need to be applied frequently, because dispersing prairie dogs can quickly repopulate treated colonies. Therefore, recent research has focussed on habitat manipulation as a means of containing or reducing populations.

In the mixed- and tallgrass prairies of Nebraska, grazing management can be used to reduce recolonization of previously controlled colonies. Prairie dogs prefer areas with short vegetation, which allows them to watch for predators and territorial invaders. When cattle are removed from a treated colony, the vegetation is able to grow more vigorously. It becomes higher, denser and intolerable to any remaining prairie dogs or any new colonizers. Deferred grazing may also be used to control prairie dogs without prior use of toxicants. A 110 acre prairie dog colony in Kansas was reduced to just 12 acres in four years when the rancher allowed his cattle to graze the town only in the early spring. He also attracted predators to the town by providing hay bales for cover. Deferred grazing may not be effective in years with low rainfall or on sites



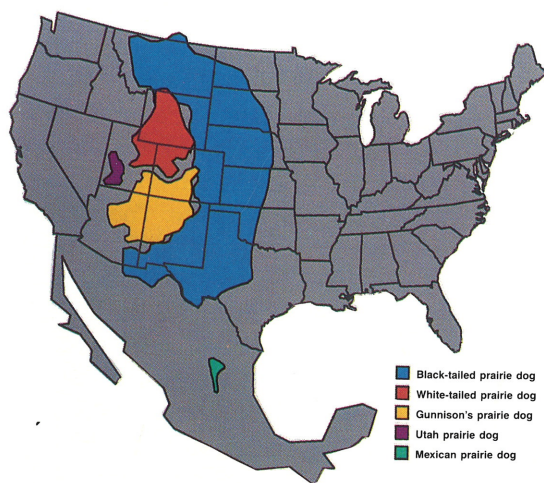
with inherently low productivity, nor will it work well in the shortgrass prairie. In these situations, artificial visual barriers, like burlap fences or windrows of evergreens, may also be used to control expansion or repopulation. These do not exclude prairie dogs from an area, but they may interfere with their predator detection system and/or social organization and cause them to leave an area. Studies have shown that the number of prairie dogs using an area with a visual barrier may be reduced 60% in one month. By using a combination of control methods (habitat modification, shooting, and toxicants) landowners can successfully reduce the impact of prairie dogs to a tolerable level.

# Prairie Dogs and Their Ecosystem



Black-tailed prairie dog

Distribution of prairie dogs in North America



If you have ever traveled in the West, you've probably noticed squirrel-like animals scampering about the prairie among large mounds of soil. The French explorers called these animals "little dogs," because of the barking noise they make. Today, they are known as "prairie dogs," and they are one of the most loved and most hated animals in the United States.

Prairie dogs are native to the plains and plateaus of western North America and play a very important role in the prairie ecosystem. If you watch prairie dogs, you will notice that the area they use is much more open than the surrounding prairie. In a nearly continuous grassland, these open patches act as the crossroads of the prairie, attracting a wide variety of plants and animals. Some of these animals, like the endangered black-footed ferrets, are rare now, because fewer prairie dogs remain to create these unique patches of habitat.

Lewis and Clark, while on their famous journey up the Missouri River in 1804, noted that this "wild dog of the prairie . . . appears here in infinite numbers." Naturalist Ernest Thompson Seton estimated that about 5 billion prairie dogs inhabited North America in the early 1900s. The

largest prairie dog colony on record, in Texas, contained an estimated 400 million prairie dogs!

The diaries of westward-bound pioneers contain numerous accounts of the abundance and humorous antics of these small prairie residents. Prairie dogs lost their comic appeal, however, when they fed on grasslands used by livestock and crops planted by early prairie settlers. The conflict between prairie dogs and land-use interests has continued throughout the twentieth century, resulting in widespread reduction of prairie dog numbers through habitat loss and control efforts.

## Prairie dog particulars

Five species of prairie dogs are found in North America: the black-tailed (*Cynomys ludovicianus*), Mexican (*C. mexicanus*), white-tailed (*C. leucurus*), Gunnison's (*C. gunnisoni*), and Utah prairie dog (*C. parvidens*). The most abundant and widely distributed of these is the black-tailed prairie dog, which, as its name indicates, has a black-tipped tail. They live in densely populated colonies or "towns," scattered across the Great Plains from northern Mexico to southern Canada. Occasionally they are found in the Rocky Mountain foothills, but rarely at elevations over 8,000 feet. A typical black-tailed prairie dog weighs one to three pounds and is 14 to 17 inches long. The Mexican prairie dog also has a black-tipped tail, but is smaller than its northern relative. They occur only in Mexico and are an endangered species. White-tailed, Gunnison's, and Utah prairie dogs all have white-tipped tails.





Young black-tailed prairie dogs

towns are often divided into wards by barriers such as ridges, lines of trees, and roads. Residents of a ward may be able to see and hear those of adjacent wards, but movement among wards is uncommon. Within a ward, each family or "coterie" of prairie dogs occupies a territory of about one acre. A coterie usually consists of a single adult male, one to four adult females, and any of their offspring less than two years old.

## The active life of a prairie dog

Prairie dogs lead active lives, both above- and belowground. They are equipped with short, muscular front legs and long claws that are useful for burrowing. One of the most obvious features of a prairie dog colony is the abundance of mounds and holes. Black-tailed prairie dog towns typically have 30 to 50 burrow entrances per acre, while Gunnison's and white-tailed prairie dog towns contain less than 20 per acre.

Each burrow entrance leads to a tunnel that is three to six feet deep and about 15 feet long, although the size and complexity of the burrow systems varies greatly. Prairie dogs often dig small chambers just below the surface, where they sit and listen for aboveground activity. Deeper belowground, they make nest chambers, where they sleep and care for their young. With the soil excavated from their tunnels, prairie dogs construct crater- and dome-shaped mounds up to two feet high and ten feet in diameter! These serve as lookout stations and prevent water from entering their tunnels. Burrowing can be beneficial to the soil because mixing soil types and incorporating organic matter enhances soil formation. It also helps to increase soil aeration and decrease compaction.

Prairie dogs are most active during the day, rising with the sun and retreating to their burrows around sunset. In the summer, prairie dogs feed mostly in the early morning and late afternoon. During the hottest part of the day (100+°F in summer), they go belowground where it is much cooler. Black-tailed prairie dogs are active all year, but may stay underground for several days during severe winter weather. On sunny winter afternoons, they come out to forage and bask in the sun's warmth. The white-tailed, Gunnison's, and Utah prairie dogs have a different approach. They hibernate from October through February, and live off their body fat during the long, cold winter.

In addition to feeding and maintaining their burrows, prairie dogs must also guard their territories from invaders. When a prairie dog trespasses into the territory of another coterie, it may be charged by any resident, male or female, young or old. If the intruder is just searching for food or exploring, it will usually retreat after this first charge. The trespasser may not be so inclined to leave, however, if it is attempting to acquire mates or expand its territory. In such cases, the dominant male from the invaded coterie and the invader will engage in a "tail-spread dispute." The dispute involves some serious posturing but only limited physical contact and continues until a new boundary is established, rarely more than a few feet from the original. A highly aggressive male, however, may fight for a new territory. When threatened by residents, he will often stand his ground, testing their tolerance. Eventually, a fight will occur between the dominant male and the intruder. The victor establishes himself as the dominant male of the coterie and the loser retreats from the area.

White-tailed prairie dogs live in sparsely populated colonies in arid regions up to 10,000 feet. They are usually smaller than black-tailed prairie dogs, weighing between 1½ and 2½ pounds. Gunnison's prairie dog, the smallest of the five species, inhabits open grassy and brushy areas up to 12,000 feet. Utah prairie dogs are a threatened species, limited to central Utah.

Prairie dogs are very social animals, living in towns, most of which range in size from one to 1,000 acres. Larger



## Communication is the key

One of the most fascinating aspects of prairie dogs is the way they communicate. Black-tailed prairie dogs have at least 11 distinct calls and a variety of postures and displays. While foraging, prairie dogs frequently lift their heads or stand on their hind legs to survey their surroundings. When a prairie dog detects danger, such as a coyote, it retreats to a burrow mound and gives a series of short nasal yips as a warning. Nearby prairie dogs stop what they are doing, stand on their hind legs and look for the source of danger. If they spot the coyote, they will run and dive into their burrows or perch atop their burrow mounds and join in the "barking" chorus. In time the prairie dogs that did go underground will cautiously emerge from their burrows. Their large eyes and inconspicuous ears are set high on their heads, enabling them to examine the area without leaving the safety of their burrows. If there are no signs of danger, the prairie dogs will come out and give a "jump-yip" call to reclaim their territory.

Members of a coterie are very sociable and maintain unity through physical contact. When two coterie members meet, they open their mouths and touch their teeth together. This "kiss" is used to distinguish a coterie member from a stranger. An intruder will often leave the area when faced by a resident with bared teeth. Coterie members, on the other hand, recognize and accept each other's presence. Following the kiss, members often partake in elaborate grooming. All coterie members groom each other: the young, in particular, are quite persistent in seeking attention from the adults.

## Life and death in a prairie dog town

Black-tailed prairie dogs reach sexual maturity after their second winter and breed only once a year. In the southern portion of their range, they breed as early as January, while in the north, the breeding season does not begin until March. The other four species of prairie dogs reach sexual maturity after their first winter and breed in March. The gestation period for prairie dogs is 34 or 35 days and litter sizes range from one to six pups. The young are born naked, blind, and helpless and remain underground for the first six weeks of their lives. The pups emerge from their dens during May or June and are weaned shortly thereafter. By the end of fall, they are nearly full grown. Survival of prairie dog pups is high compared to many other animals, in part, because they spend so much time underground. The pups are also alerted to the dangers of predators by the many sentries that watch over the town.

Females usually spend their entire lives in their original coterie, but young males move away in late spring before their first breeding season. Some move to neighboring coterie, while others travel up to five miles before establishing their own territories. Dispersal is risky business and many young prairie dogs die during this time as they leave the safety of their coterie and well-established burrows.

In the wild, prairie dog females occasionally live up to eight years, but males rarely live more than five years. Even with their sentries and underground lifestyle, predation is still a major cause of mortality. Badgers are a serious threat because they can dig deep into prairie dog burrows. Weasels and black-footed ferrets, on the other hand, do not have to dig out prairie dogs. With their stream-lined bodies, they can prowl through and capture prairie dogs in their burrows. Other predators, like coyotes, bobcats, and foxes, must rely on their ability to stalk prairie dogs feeding on the outskirts of the town. They also sit and wait at burrow entrances for unsuspecting prairie dogs to come out. Hawks and eagles regularly soar over or perch



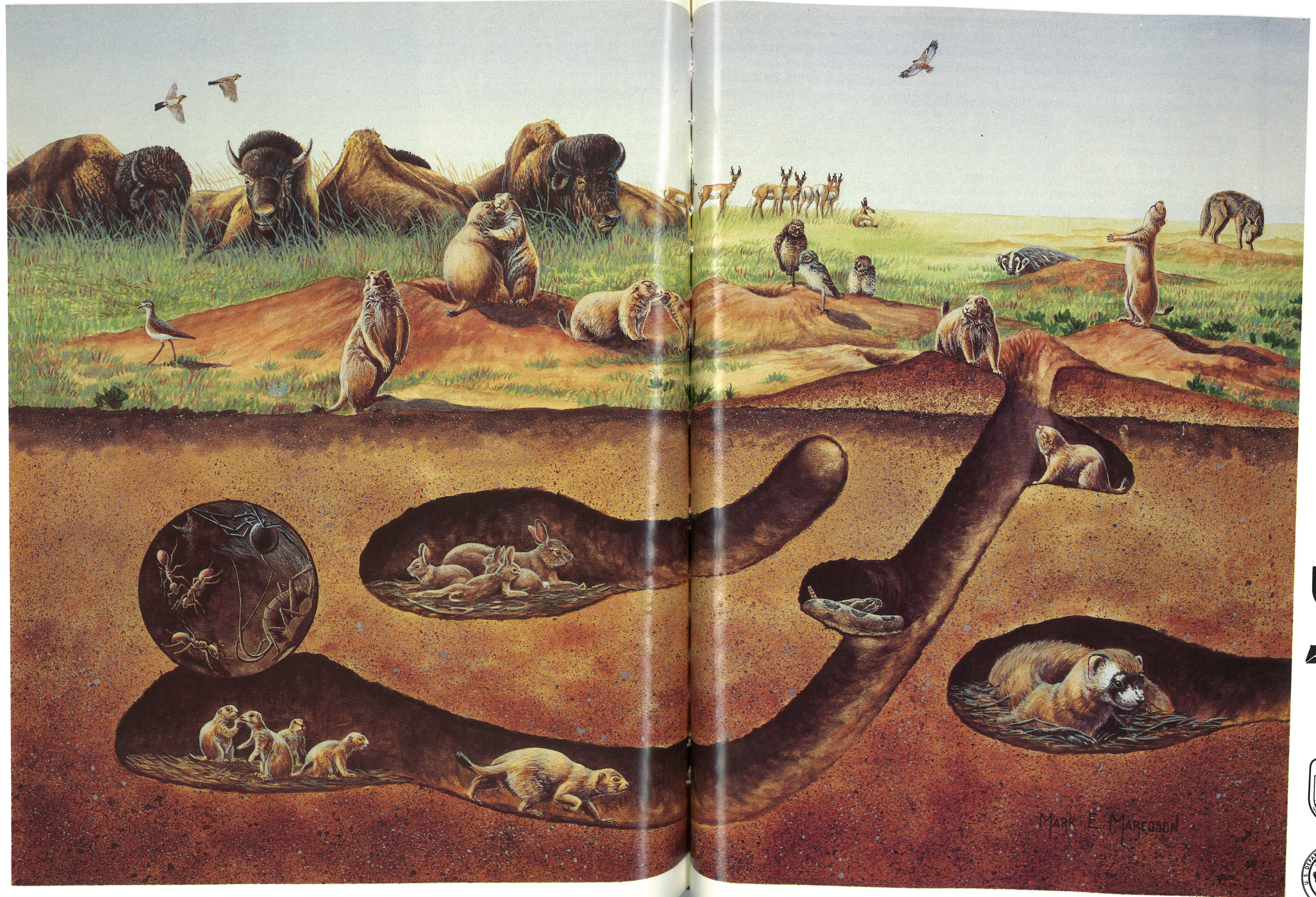
*Prairie dog communication—the "jump-yip" call*



*Common predators of prairie dogs*



# Prairie Dogs and Their Ecosystem





near towns to search for mice, rabbits and prairie dogs. Prairie rattlesnakes and bull snakes may take some young, but are not a great threat to adult prairie dogs.

Prairie dogs are susceptible to several diseases, the most notable being plague, a severe infectious disease caused by the bacterium *Yersinia pestis*. Plague is devastating in prairie dogs and other rodents, leading to the rapid decline and even disappearance of entire colonies. It is most often transmitted by the bite of an infected flea, a common parasite of prairie dogs, and although plague has been reported throughout the western United States, it is uncommon.

Plague can be transmitted to humans by the bite of an infected flea. Also known as "black death," it was responsible for the loss of one-third of Europe's population in the 1300s, before the advent of modern medicine. During the past decade there have been less than 5 cases of human plague per year in the United States, very few of which have been acquired in prairie dog towns. Symptoms include swollen and tender lymph nodes, chills, and fever. The disease is curable in humans if diagnosed and treated in its early stages. Awareness of the disease and avoidance of close contact with prairie dogs and other rodents are the keys to protecting you and your family from exposure to plague.

Two other threats to humans in prairie dog towns are rattlesnakes and black widow spiders. Both are quite secretive and avoid contact with humans when given the chance, but they can deliver painful and potentially dangerous bites if threatened or disturbed. Rattlesnakes often rest in prairie dog burrows during the day and move through towns at night in search of food. Black widow spiders are most often found in abandoned prairie dog holes where they form a web and have their young. Bites from these animals are rare. You can safely enjoy exploring prairie dog towns if you use a little caution.

Other mortality factors that affect prairie dogs include accidents, starvation, weather, parasites, and other diseases, but human activities have caused the greatest loss. Turning native prairie into cultivated fields has destroyed much of the original grasslands occupied by prairie dogs. In addition, ranchers have applied control measures since the turn of the century to reduce prairie dog populations that are believed to compete with livestock for forage on rangelands. Prairie dogs occupied up to 700 million acres of western grasslands in the early 1900s. Today, about 2 million acres remain.



Prairie dogs feed on grasses and forbs

## Plants and prairie dogs

Prairie dogs spend most of their aboveground-time foraging. In the spring and summer, they each consume up to two pounds of green grasses and forbs (broad-leafed, non-woody plants) per week. Grasses are the preferred food, making up 70–95% of their diet, but forbs become more important in the fall, as green grass becomes scarce. Prairie dogs also eat seeds and insects as they prepare for colder weather. In the winter, black-tailed prairie dogs will eat any available green plant parts, even roots.

The ability of a plant species to survive in a prairie dog town depends on how well it can withstand the activities of livestock, prairie dogs and other wildlife. On mixed- and tall-grass prairies, the persistent burrowing and feeding by prairie dogs can, over time, change the number and type of plants growing in that area. The grasses found on prairie dog towns are more characteristic of the short-grass prairie. With reduced competition from the tall grasses, many other plant species, especially forbs, can become

established. Rainfall and site characteristics also have an important effect on the changes that occur.

In short-grass prairies, the number of plant species, particularly forbs, increases because of the digging and scratching activities of prairie dogs that disturb the soil. These patches of bare soil provide excellent sites for annual forbs to become established. Annual grasses are uncommon in prairie dog towns because they are clipped or eaten before the seeds mature. Perennial grasses, on the other hand, are not as affected since they do not rely on seeds to produce new plants, but rather spread by roots and stems. Long-term use of an area by prairie dogs appears to promote buffalograss and grama grasses.

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As mentioned earlier, prairie dogs have many enemies. Part of their defense relies on having a clear view of their surroundings and communicating with each other. In addition to using their mounds as sentry posts, they reduce the height of surrounding vegetation by grazing, and black-tailed prairie dogs clip taller plants that interfere with their line of vision.

## Animal interests

Historically, prairie dogs had help establishing their towns from the immense herds of bison that roamed the Great Plains. The bison grazed patches of the mixed-grass prairie, keeping the vegetation short enough for prairie dogs to colonize. Prairie dogs alone had difficulty maintaining towns in mixed-grass prairie. The bison, however, would return occasionally to feed on the actively growing and highly nutritious vegetation. Mule deer and elk also preferred to eat the more nutritious vegetation in towns, and pronghorn antelope were attracted by the abundant forbs.

Prairie dog colonies are unique patches of habitat that attract a wide variety of wildlife. One study identified more than 140 species of wildlife associated with prairie dog towns. Vacant prairie dog burrows serve as homes for cottontail rabbits and several species of small rodents. Deer mice and kangaroo rats are attracted by the annual plants that grow on the disturbed soils, while grasshopper mice feed on the beetles, grasshoppers, and other small rodents found in abundance on prairie dog towns.

Many birds, such as meadowlarks and grasshopper sparrows, appear in greater numbers on prairie dog towns than in surrounding prairie. These songbirds are attracted by the increased amount and visibility of seeds and insects. A very interesting bird often seen perched on prairie dog mounds is the burrowing owl. These owls typically nest in abandoned prairie dog burrows or badger holes. They rarely feed on prairie dogs, but instead, prefer the insects and smaller mammals found nearby. The burrowing owl is only one of several uncommon or rare species that frequent prairie dog towns. Others include the golden eagle, prairie falcon, ferruginous hawk, mountain plover, swift fox, and black-footed ferret.

The black-footed ferret is a special inhabitant of prairie dog towns. Today, this animal is so rare that it is listed as an endangered species. Black-footed ferrets establish their dens in prairie dog burrows and feed almost exclusively on prairie dogs. It is not known, however, if these ferrets were ever abundant enough to have had a serious impact on prairie dog populations. The reduction in prairie dog numbers in the last 100 years and the isolation and disappearance of many large towns has led to the decline of the ferret population.

Several times during this century, scientists have believed that the black-footed ferret was extinct. Fortunately, in 1981, a small population of ferrets was discovered near Meeteetse, Wyoming. The loss of prairie dogs to plague and bouts with canine distemper nearly eliminated these ferrets. Survivors were captured, and a successful captive breeding program has set the stage for reintroduction of ferrets into the wild. If black-footed ferrets are to survive in the wild, we need to ensure that they are provided with their preferred habitat—large and healthy prairie dog towns.

## Prairie dog management

During the mid- to late-1800s, there was a large influx of livestock across the Great Plains. Continuous grazing by cattle and sheep in the mixed- and tall-grass prairie allowed prairie dogs to spread eastward rapidly. Large prairie dog towns were established in eastern Kansas, Nebraska, Oklahoma, and the Dakotas. Even today, continuous livestock grazing on rangeland encourages use by prairie dogs.

Unfortunately, the presence of large, healthy prairie dog towns is not always compatible with agricultural interests. The impacts of prairie dogs on grasslands and livestock production



*The  
burrowing  
owl*



*The  
black-  
footed  
ferret*



are difficult to determine and depend on several factors, such as the number of prairie dogs, the size and age of towns, the presence of livestock and other grazers, site conditions, and weather. Prairie dogs feed on many of the same grasses and forbs that livestock do. In addition, they often begin feeding on pastures and rangeland earlier in the spring and clip plants closer to the ground. Through their persistent feeding, prairie dogs can reduce present and future forage yields for livestock. Other evidence, however, indicates that prairie dogs may have little or no significant effect on livestock production. Prairie dogs maintain vegetation at a higher nutritional level by continuously promoting new growth. In addition, they sometimes feed on and remove plants that are toxic to livestock. Therefore, the reduction of available forage may be partially compensated for by the improved quality of the forage. The amount of competition between prairie dogs and livestock is difficult to determine and is still under investigation.

As settlers moved into the Great Plains, prairie dogs were viewed as pests. Since 1900, prairie dog populations have been reduced up to 98% in some areas and eliminated in others. This is largely the result of cultivation of prairie soils and prairie dog control programs. Many ranchers tolerate some prairie dogs but are concerned about large towns and expanding populations. Today, prairie dog control is practiced by ranchers and government agencies, although to a lesser extent than in the early- to mid-1900s. Most toxicants for prairie dog control have been removed from the market because of the hazards they present to other wildlife and the environment. Therefore, fewer options are available to landowners faced with prairie dog problems. Recent research has shown some potential for the use of more specific and non-lethal means of controlling prairie dogs, such as barrier fences and improved range management.

## Conclusion

Prairie dogs play an important role in their ecosystem by creating islands of unique habitat in a sea of grasslands. Their daily activities change the physical characteristics of the community, which leads to increased plant and animal diversity. Prairie dogs are a source of food for several predators, and their burrows provide homes for a variety of species, including burrowing owls and the endangered black-footed ferret. They also provide recreational opportunities for nature observers, photographers, and sportsmen. The presence of large, healthy prairie dog towns, however, is not always compatible with agriculture and other human land-use interests, but we can coexist. We should strive to conserve prairie dog ecosystems and maintain populations at tolerable levels. Through proper management we can ensure that the complex community of plants and animals that are supported by and dependent on prairie dogs can continue to meet at the crossroads of the prairie.

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## OVERALL DISCUSSION AND CONCLUSIONS

The papers in this thesis focussed on one of the more controversial wildlife species on the Great Plains -- the black-tailed prairie dog. These animals create unique patches of habitat that are attractive to many other species. They also provide recreational opportunity for wildlife observers and photographers. At the same time, prairie dogs also damage agricultural and range resources and may threaten human health and safety. As a result, much time and money has been spent on prairie dog control.

Prairie dogs may be controlled directly through shooting, toxic baits, and burrow fumigation. The use of toxicants can be up to 95% effective, but can also be costly and is becoming more socially unacceptable. On public lands these methods are even more controversial because of the potential impact on other wildlife species, particularly the black-footed ferret. Therefore, the problem of black-tailed prairie dog management must be dealt with in a manner that is conducive to the needs of both the public and wildlife.

This thesis project has provided the public with information on the biology, behavior, and management of black-tailed prairie dogs and their role as ecosystem regulators. The first article will appear in the June 1991 issue of NEBRASKAland and will reach 60,000 people. One-hundred thousand copies of the "Prairie dogs and their ecosystem" brochure were produced and distributed to Cooperative Extension and U. S. Fish and Wildlife Service offices. These publications are helpful in dispelling myths surrounding

prairie dogs. They also provide landowners who have a colony of prairie dogs with some appreciation for the animal, so that they may re-evaluate the level of management required. At the same time, these articles discuss the need for proper prairie dog management, which people who are not associated with the animal may not recognize.

Prairie dog management is a controversial issue and a critical one with regard to black-footed ferret management. Therefore, management techniques, like deferred grazing and visual barriers, need to be further explored. The snowfence material tested in this study did not appear to affect the use of an area by black-tailed prairie dogs. Its efficacy at reducing repopulation of treated areas and invasion of new areas needs to be examined. Also, materials that have lower see-through visibility than Tensar snowfence, but that do have its durability should be tested. Behavioral studies on prairie dogs exposed to burlap fences, windrows of pine trees, and other materials could be conducted to determine exactly why some materials are effective. A great potential exists for the use of visual barriers to contain prairie dog populations on public lands, where black-footed ferrets are reintroduced.